

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Re: Appeal to the Board of Patent Appeals and Interferences

In re PATENT APPLICATION of
Inventor(s): Mills

Group Art Unit: 1754

Appln. No.: 09/669,877

Examiner: Tsang-Foster
for Secret Committee

Filing Date: 09/27/2000

Date: October 22, 2004

Title: ONE ELECTRON ATOM CATALYSIS, INCREASED BINDING ENERGY COMPOUNDS AND APPLICATIONS THEREOF

Sir:

- 1 ☒ **NOTICE OF APPEAL:** Applicant hereby appeals to the Board of Patent Appeals and Interferences from the decision (not Advisory Action) dated of the Examiner twice/finally rejecting claims
- 2 ☐ **BRIEF** on appeal in this application attached in triplicate.
- 3 ☐ An **ORAL HEARING** is respectfully requested under Rule 194 (due two months after Examiner's Answer – unextendable).
- 4 ☐ Reply Brief is attached in triplicate (due two months after Examiner's Answer – unextendable).
- 5 ☒ "Small entity" ☐ herewith. ☒ previously.

6	FEE CALCULATION:	Large/Small Entity	
If box 1 above is X'd, see box 12 below <u>first</u> and decide: enter		\$	\$170
If box 2 above is X'd, see box 12 below <u>first</u> and decide: enter		\$	\$
If box 3 above is X'd, see box 12 below <u>first</u> and decide: enter		\$	\$
If box 4 above is X'd, enter nothing		- 0 - (no fee)	
7. Original due date: Petition Requested and Fees Paid In Accompanying Fee Transmittal			
8. Petition is hereby made to extend the original due date to cover (1 months) \$ the date this response is filed for which the requisite fee is attached (2 months) \$ (3 months) \$ (4 months) \$ (5 months) \$			
9. Enter any previous extension fee paid [] previously since above <u>original</u> due date (item 7); [X] with concurrently filed amendment		-	
10. Subtract line 9 from line 8 and enter: Total Extension Fee			+170
11. TOTAL FEE ATTACHED =			\$170

12. ☐ *Fee **NOT** required if/since paid in prior appeal in which the Board of Patent Appeals and Interferences did not render a decision on the merits.

CHARGE STATEMENT: The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. 50-0687/62226 for which purpose a duplicate copy of this sheet is attached. **This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed.**

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* * * * *

October 22, 2004

**RESPONSE TO FINAL OFFICE ACTION, NOTICE OF APPEAL
AND REQUEST TO REMOVE FINALITY OF OFFICE ACTION**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicant files this paper in response to the final Office Action mailed April 22, 2004. Also enclosed is a Petition for a three-month extension and Notice of Appeal together with the appropriate fees.

Reconsideration and allowance of the subject application are respectfully requested. Claims 1-28 are pending in the present application.

Submitted with this Response is new, non-cumulative scientific evidence further demonstrating the existence of lower energy states of hydrogen in many different ways, including, but not limited to, studies of spectroscopic lines, energy output, compositions of matter, generated plasmas, and inverted hydrogen populations. As detailed below, Applicant also identifies the independent third-party data pursuant to the PTO's agreement, which evidence resulted in verbal confirmation by Examiner Langel that two BlackLight applications handled by him were allowable before he was told to misrepresent that fact and, thus, was forced to resign from the cases "for moral and ethical reasons."

Despite the Committee's official "allowance is not an option" policy, as also revealed by Examiner Langel, Applicant must insist that the anonymous group of individuals, i.e. "Secret Committee," responsible for directing the named Examiner's actions in this case properly consider and evaluate in detail this and all other evidence of record, which so far has been essentially ignored. To the extent that the Committee finds fault with any of the scientific data, that those findings be communicated to provide Applicant a full and fair opportunity to respond.

The rejection of claims 1-28 under 35 U.S.C. § 101 as being inoperative and lacking utility is respectfully traversed. Applicant respectfully submits that the Secret Committee has not met its burden of raising a *prima facie* case of inoperability for the many reasons of record and, therefore, the rejection should be withdrawn for those reasons alone. Furthermore, Applicant has disclosed substantial experimental evidence in the present disclosure, prior submissions, and submissions herewith that fully rebut any *prima facie* case of inoperability the Committee might have raised. Applicant responds more fully to the Committee's comments, discusses the experimental evidence of record, and summarizes the improper prosecution procedures used by the Committee in the following paragraphs. For these additional reasons, the Section 101 rejection should be withdrawn.

The related rejection of claims 1-28 under 35 U.S.C. § 112, first paragraph, as lacking enablement, is also respectfully traversed. Applicant respectfully submits that the Committee has not met its burden of raising a *prima facie* case of lack of enablement for the many reasons of record and, therefore, the rejection should be withdrawn for those reasons alone. Furthermore, Applicant has disclosed substantial experimental evidence in the present disclosure, prior submissions, and submissions herewith that fully rebut any *prima facie* case of lack of enablement the Committee might have raised. Applicant responds more fully to the Committee's comments, discusses the experimental evidence of record, and summarizes the improper prosecution procedures used by the Committee in the following paragraphs. For these additional reasons, the Section 112, first paragraph, rejection should be withdrawn.

Applicant also files herewith a Rule 132 Declaration certifying his newly submitted experimental evidence, which further rebuts the Committee's unjustified utility

and enablement rejections of the claimed invention. This evidence, which the PTO required Applicant to submit to scientific journals for publication, conclusively confirms the formation of lower-energy hydrogen through practice of Applicant's novel hydrogen chemistry. To this day, the Committee has failed to properly consider the numerous Rule 132 Declarations previously filed by Applicant in violation of its own rules, as outlined in MPEP § 716:

Evidence traversing rejections must be considered by the examiner whenever present. All entered affidavits, declarations, and other evidence traversing rejections are acknowledged and commented upon by the examiner in the next succeeding action. ... Where the evidence is insufficient to overcome the rejection, the examiner must specifically explain why the evidence is insufficient. General statements such "the declaration lacks technical validity" or "the evidence is not commensurate with the scope of the claims" without an explanation supporting such findings are insufficient. [Emphasis added.]

The Committee does not even mention, let alone consider, most of the certified experimental evidence identified in Applicant's Rule 132 Declarations that were submitted to overcome the rejections of record.

To the limited extent that the Committee has considered Applicant's evidence in any of his pending cases, that consideration primarily relies upon the biased arguments of Dr. Bernard Souw. As Applicant shows below, those biased arguments lack credibility not just on the merits, but also due to a genuine conflict of interest involving Dr. Souw's contemporaneous ownership of, and work for, a company that competes with BlackLight. Consequently, the Committee's rejections in all of BlackLight's cases, including this one, are fatally defective and should be immediately withdrawn so that these cases can be allowed to issue.

With this latest submission, Applicant now has over 100 articles and books of record in this case, as reflected in the "List of References" set forth below.¹ These articles detail studies that experimentally confirm a novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than

¹ While the articles and books numbered 1-70 were already made of record in previous submissions, many of those articles have now been published. Therefore, Applicant submits herewith copies of articles 50-101.

the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and novel hydride compounds, including:

extreme ultraviolet (EUV) spectroscopy²,
characteristic emission from catalysis and the hydride ion products³,
lower-energy hydrogen emission⁴,
plasma formation⁵,
Balmer α line broadening⁶,
population inversion of hydrogen lines⁷,
elevated electron temperature⁸,
anomalous plasma afterglow duration⁹,
power generation¹⁰,
excessive light emission¹¹,
analysis of chemical compounds¹², and
direct plasma to electric power conversion¹³.

Lower-Energy Hydrogen Experimental Data:

1.) the observation of intense extreme ultraviolet (EUV) emission at low temperatures (e.g. $\approx 10^3$ K) from atomic hydrogen and only those atomized elements or gaseous ions which provide a net enthalpy of reaction of approximately $m \cdot 27.2$ eV via the ionization of t electrons to a continuum energy level where t and m are each an integer (e.g. K and Cs atoms and Rb⁺ and Sr⁺ ions ionize at integer multiples of the potential energy of atomic hydrogen and caused emission; whereas, the chemically similar atoms, Na, Mg, and Ba, do not ionize at integer multiples of the potential energy of atomic hydrogen and caused no emission)¹⁴,

² Reference Nos. 11-16, 20, 24, 27-29, 31-36, 39, 42, 43, 46-47, 50-52, 54, 55, 57, 59, 63, 65-68, 70-76, 78, 79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104

³ Reference Nos. 24, 27, 32, 39, 42, 46, 51, 52, 55, 57, 68, 72, 73, 81, 89, 91

⁴ Reference Nos. 14, 28, 29, 33-36, 50, 63, 67, 70, 71, 73, 75, 76, 78, 79, 86, 87, 90, 92, 93, 98, 101, 104

⁵ Reference Nos. 11-13, 15, 16, 20, 24, 27, 32, 39, 42, 46, 47, 51, 52, 54, 55, 57, 72, 81, 89, 91-93

⁶ Reference Nos. 16, 20, 30, 33-37, 39, 42, 43, 49, 51, 52, 54, 55, 57, 63-65, 68, 69, 71-74, 81-85, 88, 89, 91-93, 95-97, 105

⁷ Reference Nos. 39, 46, 51, 54, 55, 57, 59, 65, 66, 68, 74, 83, 85, 89, 91

⁸ Reference Nos. 34-37, 43, 49, 63, 67, 73

⁹ Reference Nos. 12, 13, 47, 81

¹⁰ Reference Nos. 30, 31, 33, 35, 36, 39, 43, 50, 63, 71-73, 76, 77, 81, 84, 89, 92, 93, 98

¹¹ Reference Nos. 11, 16, 20, 23, 31, 37, 43, 52, 72

¹² Reference Nos. 6-10, 19, 25, 38, 41, 44, 45, 60-62, 64, 69, 75, 81, 82, 87, 88, 90, 92-94, 98, 100, 101, 104

¹³ Reference Nos. 18, 26, 40, 48, 56, 68

¹⁴ Reference Nos. 11-13, 15, 16, 20, 24, 27, 32, 39, 42, 46, 47, 51, 52, 54, 55, 57, 72, 81, 89, 91-93

2.) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9, 11, 12$ or these lines inelastically scattered by helium atoms in the excitation of $\text{He}(1s^2)$ to $\text{He}(1s^1 2p^1)$ that were identified as hydrogen transitions to electronic energy levels below the "ground" state corresponding to fractional quantum numbers¹⁵,

3.) the observation of novel EUV emission lines from microwave and glow discharges of helium with 2% hydrogen at 44.2 nm and 40.5 nm with energies of $q \cdot 13.6 + \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \cdot 13.6 \text{ eV}$ where $q = 2$ and $n_f = 2, 4$ $n_i = \infty$ that corresponded to multipole coupling to give two-photon emission from a continuum excited state atom and an atom undergoing fractional Rydberg state transition¹⁶,

4.) the identification of transitions of atomic hydrogen to lower energy levels corresponding to lower-energy hydrogen atoms in the extreme ultraviolet emission spectrum from interstellar medium and the sun¹⁷,

5.) the observation that the novel EUV series of lines with energies of $q \cdot 13.6 \text{ eV}$ was observed with an Evenson microwave cell, only the peak corresponding to $q = 2$ was observed with an RF cell, and none of the peaks were observed with a glow discharge cell¹⁸,

6.) the observation that in a comparison of Evenson, McCarroll, cylindrical, and Beenakker microwave cavity plasmas, the novel EUV series of lines with energies of $q \cdot 13.6 \text{ eV}$ was only observed for Evenson-cavity helium-hydrogen plasmas¹⁹,

7.) the EUV spectroscopic observation of lines for a hydrogen- K catalyst plasma by the Institut für Niedertemperatur-Plasmaphysik e.V. that could be assigned to transitions of atomic hydrogen to lower energy levels corresponding to fractional

¹⁵ Reference Nos. 28, 33-36, 50, 63, 67, 71, 73, 75, 76, 78, 86, 87, 90

¹⁶ Reference Nos. 36, 71, 73

¹⁷ Reference Nos. 1, 5, 17, 28, 29

¹⁸ Reference Nos. 71, 73

¹⁹ Reference No. 76

principal quantum numbers and the emission from the excitation of the corresponding hydride ions²⁰,

8.) the recent analysis of mobility and spectroscopy data of individual electrons in liquid helium which shows direct experimental confirmation that electrons may have fractional principal quantum energy levels²¹,

9.) the observation of novel EUV emission lines from microwave discharges of argon or helium with 10% hydrogen that matched those predicted for the reaction $H(1/4) + H^+ \rightarrow H_2(1/4)^+$ having an energy spacing of 2^2 times the transition-state vibrational energy of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$ ²²,

10.) the result that the novel vibrational series for the reaction $H(1/4) + H^+ \rightarrow H_2(1/4)^+$ was only observed for catalyst plasmas of helium, neon, and argon mixed with hydrogen, but not with noncatalyst xenon or krypton mixed plasmas²³,

11.) the observation that based on the intensities of the peaks, the catalyst and the plasma source dependence of the reaction rate to form $H_2(1/4)^+$ is $Ar^+ > He^+ > Ne^+$ and microwave > glow discharge >> RF, respectively²⁴,

12.) the observation that the microwave plasma source dependence of the reaction rate to form $H_2(1/4)^+$ is Evenson microwave > McCarroll, cylindrical, Beenakker²⁵,

13.) the observation of rotational lines in the 145-300 nm region from atmospheric pressure 15 keV electron-beam excited argon-hydrogen plasmas where the unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)^+$ ²⁶,

²⁰ Reference No. 14

²¹ Reference Nos. 17, 53

²² Reference Nos. 29, 70, 73, 79, 92, 93, 98, 101, 104

²³ Reference Nos. 29, 70, 73, 79, 92, 93, 101

²⁴ Reference No. 70

²⁵ Reference No. 79

²⁶ Reference No. 98, 101, 104

14.) the observation of a series of vibration-rotational bands in the 60-67 nm region, a high-energy region for which vibration-rotational spectra are ordinarily unknown, emitted from low-pressure helium-hydrogen (99/1%) microwave plasmas that matched the predicted energy spacing of the vibrational energy of H_2 about the bond energy of $H_2(1/2)$ corresponding to the reaction $2H(1/2) \rightarrow H_2(1/2)$ ²⁷,

15.) the observation of EUV plasma emission spectra in the region 60 nm to 100 nm that matched the predicted emission lines $E_{D H_2}$ due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at energies of $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$ to longer wavelengths for $\nu^* = 2$ to $\nu^* = 32$ and to shorter wavelengths for $\nu^* = 1$ to $\nu^* = 16$ to within the spectrometer resolution of about $\pm 0.05\%$ ²⁸,

16.) the observation that in addition to members of the series of novel emission lines with energies of $q \cdot 13.6 \text{ eV}$ or $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$ an additional intense peak was observed from a scaled-up Evenson cell at 41.6 nm with an energy of 29.81 eV that matched $q \cdot 13.6 \text{ eV}$ with $q = 4$ less 24.58741 eV corresponding to inelastic scattering of these photons by helium atoms due to ionization of He to He^+ ²⁹,

17.) the observation that in a comparison of Evenson, McCarroll, cylindrical, and Beenakker microwave cavity plasmas, the novel series of spectral lines due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at energies of $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$ was only observed for Evenson-cavity helium-hydrogen and neon-hydrogen plasmas³⁰,

18.) the observation by gas chromatography that hydrogen was consumed by the helium-hydrogen plasmas which showed the novel EUV series of lines with energies of $q \cdot 13.6 \text{ eV}$, the novel series of spectral lines due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at energies of $E_{D+vib} = 17.913 \pm \left(\frac{\nu^*}{3}\right) 0.515902 \text{ eV}$, extraordinary H

²⁷ Reference No. 99

²⁸ Reference Nos. 50, 75, 76, 78, 86, 87, 90

²⁹ Reference No. 86

³⁰ Reference No. 76

Balmer line broadening corresponding to 180 - 210 eV , and excess power of 21.9 W in 3 cm^{331} ,

19.) the observation of the dominant He^+ emission and an intensification of the plasma emission observed when He^+ was present with atomic hydrogen demonstrated the role of He^+ as a catalyst³²,

20.) the observation of continuum state emission of Cs^{2+} and Ar^{2+} at 53.3 nm and 45.6 nm, respectively, with the absence of the other corresponding Rydberg series of lines from these species which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen to the either Cs or Ar^+ catalyst³³,

21.) the spectroscopic observation of the predicted hydride ion $H^-(1/2)$ of hydrogen catalysis by either Cs or Ar^+ catalyst at 407 nm corresponding to its predicted binding energy of 3.05 eV^{34} ,

22.) the observation of characteristic emission from K^{3+} which confirmed the resonant nonradiative energy transfer of 3·27.2 eV from atomic hydrogen to atomic K^{35} ,

23.) the spectroscopic observation of the predicted $H^-(1/4)$ ion of hydrogen catalysis by K catalyst at 110 nm corresponding to its predicted binding energy of 11.2 eV^{36} ,

24.) the observation of characteristic emission from Rb^{2+} which confirmed the resonant nonradiative energy transfer of 27.2 eV from atomic hydrogen to Rb^+^{37} ,

25.) the spectroscopic observation of the predicted $H^-(1/2)$ ion of hydrogen catalysis by Rb^+ catalyst at 407 nm corresponding to its predicted binding energy of 3.05 eV^{38} ,

³¹ Reference No. 76

³² Reference Nos. 36, 73

³³ Reference Nos. 24, 39, 51, 54, 55, 57, 91

³⁴ Reference No. 24

³⁵ Reference Nos. 27, 39, 42, 46, 51, 54, 55, 57, 81, 89, 91

³⁶ Reference Nos. 27, 42, 81

³⁷ Reference Nos. 32, 39, 42, 46, 51, 54, 55, 57, 81, 89, 91

³⁸ Reference No. 32

26.) the observation of $H^-(1/2)$, the hydride ion catalyst product of K^+ / K^+ or Rb^+ , at its predicted binding energy of 3.0468 eV by high resolution visible spectroscopy as a continuum threshold at 4068.2 \AA and a series of structured peaks separated from the binding energy by an integer multiple of the fine structure of $H(1/2)$ starting at 4071 \AA that matched predicted free-free transitions³⁹,

27.) the observation that the high resolution visible K^+ / K^+ or $Rb^+ - H_2$ plasma emission spectra in the region of 3995 to 4060 \AA matched the predicted bound-free hyperfine structure lines E_{HF} of $H^-(1/2)$ calculated from the electron g factor as $E_{HF} = j^2 3.00213 \times 10^{-5} + 3.0563 \text{ eV}$ (j is an integer) for $j = 1$ to $j = 39$ (3.0563 eV to 3.1012 eV —the hydride binding energy peak plus one and five times the spin-pairing energy, respectively) to within a 1 part per 10^{440} ,

28.) Rb^+ or $2K^+$ catalysts formed a plasma having strong VUV emission with a stationary inverted Lyman population with an overpopulation sufficient for lasing, and emission from $H^-(1/2)$ was observed at 4071 \AA corresponding to its predicted binding energy of 3.0468 eV with the fine structure and its predicted bound-free hyperfine structure lines $E_{HF} = j^2 3.00213 \times 10^{-5} + 3.0563 \text{ eV}$ (j is an integer) that matched for $j = 1$ to $j = 37$ to within a 1 part per 10^{441} ,

29.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing at wavelengths over a wide range from micron to blue wherein molecular oxygen served as the catalyst as supported by O^{2+} emission and H Balmer line broadening of 55 eV compared to 1 eV for hydrogen alone⁴²,

30.) the observation of H Balmer line broadening of 55 eV compared to 1 eV for hydrogen alone at distances up to 5 cm from the coupler⁴³,

³⁹ Reference Nos. 39, 42, 46, 57, 81, 89, 91

⁴⁰ Reference Nos. 39, 42, 46, 57, 81, 89, 91

⁴¹ Reference Nos. 39, 42, 46, 51, 54, 55, 57, 81, 89, 91

⁴² Reference Nos. 59, 65, 66, 68, 74, 83, 85

⁴³ Reference No. 74

31.) the observation that with a microwave input power of $9 \text{ W} \cdot \text{cm}^{-3}$, a collisional radiative model showed that the hydrogen excited state population distribution was consistent with an $n = 1 \rightarrow 5,6$ pumping power of an unprecedented $200 \text{ W} \cdot \text{cm}^{-3}$ permissive of gas laser efficiencies orders of magnitude those of conventional visible gas lasers and direct generation of electrical power using photovoltaic conversion of the spontaneous or stimulated water vapor plasma emission⁴⁴;

32.) the observation of stimulation of the stationary inverted H Balmer population from a low pressure water-vapor microwave discharge plasma by back illumination with an infrared source that showed depopulation of the $n = 5$ state⁴⁵,

33.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing was observed for Evenson microwave plasmas, but not for RF or discharge plasmas⁴⁶,

34.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing that was dependent on the microwave plasma source with the highest inversion from Evenson microwave plasmas⁴⁷,

35.) the observation of stationary inverted H Balmer and Lyman populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing that was dependent on the pressure of the Evenson microwave plasma⁴⁸,

36.) the observation of stationary inverted H Balmer populations from a low pressure water-vapor microwave discharge plasma with an overpopulation sufficient for lasing at distances up to 5 cm from the coupler⁴⁹,

⁴⁴ Reference Nos. 68, 83, 85

⁴⁵ Reference Nos. 59, 65, 68, 85

⁴⁶ Reference Nos. 59, 65, 66, 68, 73, 83, 85

⁴⁷ Reference No. 83

⁴⁸ Reference Nos. 59, 68, 73, 83, 85

⁴⁹ Reference No. 74

37.) the observation that the requirement for the natural hydrogen-oxygen stoichiometry of the Evenson water plasma was stringent in that a deviation by over 2% excess of either gas caused a reversal of the H inversion in water vapor plasmas⁵⁰,

38.) the observation of a typical slow H population for a water-vapor plasma maintained in a GEC-type cell that was independent of time, and a new phenomenon, an extraordinary fast population that increased from zero to a significant portion of the Balmer α emission with time under no-flow conditions wherein the peak width and energy increased with time up to a 0.7 nm half-width corresponding to an average hydrogen atom energy of 200 eV⁵¹,

39.) the observation of a substantial fast H population (~20% at 40 eV) for a water-vapor plasmas maintained in a GEC-type cell that was independent of position including regions where the electric field was orders of magnitude too low to explain the extraordinarily high Doppler energies⁵²,

40.) the observation of fast H population (40-50 eV) for a He/H_2 (95/5%), Ar/H_2 (95/5%), and H_2 plasmas maintained in a GEC-type cell that was independent of position including regions where the electric field was orders of magnitude too low to explain the extraordinarily high Doppler energies⁵³,

41.) the observation by the Institut für Niedertemperatur-Plasmaphysik e.V. of an anomalous plasma and plasma afterglow duration formed with hydrogen-potassium mixtures⁵⁴,

42.) the observation of anomalous afterglow durations of plasmas formed by catalysts providing a net enthalpy of reaction within thermal energies of $m \cdot 27.28 \text{ eV}$ ⁵⁵,

43.) the formation of a chemically generated hydrogen plasma with the observation of Lyman series in the EUV that represents an energy release about 10

⁵⁰ Reference Nos. 59, 68, 83, 85

⁵¹ Reference No. 95

⁵² Reference No. 96

⁵³ Reference Nos. 92, 93, 97, 105

⁵⁴ Reference Nos. 13, 47, 81

⁵⁵ Reference Nos. 12, 13, 47, 81

times that of hydrogen combustion which is greater than that of any possible known chemical reaction⁵⁶,

44.) the observation of line emission by the Institut für Niedertemperatur-Plasmaphysik e.V. with a 4° grazing incidence EUV spectrometer that was 100 times more energetic than the combustion of hydrogen⁵⁷,

45.) the excessive increase in the Lyman emission upon the addition of helium or argon catalyst to a hydrogen plasma⁵⁸,

46.) the observation of the characteristic emission from Sr^+ and Sr^{3+} that confirmed the resonant nonradiative energy transfer of $2 \cdot 27.2 \text{ eV}$ from atomic hydrogen to Sr^+ ⁵⁹,

47.) the observation of anomalous plasmas formed with Sr and Ar^+ catalysts at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source⁶⁰,

48.) the observation that the optically measured output power of gas cells for power supplied to the glow discharge increased by over two orders of magnitude depending on the presence of less than 1% partial pressure of certain catalysts in hydrogen gas or argon-hydrogen gas mixtures, and an excess thermal balance of 42 W was measured for the 97% argon and 3% hydrogen mixture versus argon plasma alone⁶¹,

49.) the observation that glow discharge plasmas of the catalyst-hydrogen mixtures of strontium-hydrogen, helium-hydrogen, argon-hydrogen, strontium-helium-hydrogen, and strontium-argon-hydrogen showed significant Balmer α line broadening corresponding to an average hydrogen atom temperature of 25 - 45 eV; whereas, plasmas of the noncatalyst-hydrogen mixtures of pure hydrogen, krypton-hydrogen,

⁵⁶ Reference Nos. 11-13, 15, 16, 20, 24, 27, 32, 39, 42, 46, 47, 51, 52, 54, 55, 57, 72, 81, 89, 91

⁵⁷ Reference No. 14

⁵⁸ Reference Nos. 20, 31, 37, 43

⁵⁹ Reference Nos. 16, 52

⁶⁰ Reference Nos. 11, 16, 20, 23, 52, 72

⁶¹ Reference No. 22

xenon-hydrogen, and magnesium-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of $\approx 3 \text{ eV}$ ⁶²,

50.) the observation that microwave helium-hydrogen and argon-hydrogen plasmas having catalyst Ar^+ or He^+ showed extraordinary Balmer α line broadening due to hydrogen catalysis corresponding to an average hydrogen atom temperature of 110-130 eV and 180-210 eV , respectively; whereas, plasmas of pure hydrogen, neon-hydrogen, krypton-hydrogen, and xenon-hydrogen showed no excessive broadening corresponding to an average hydrogen atom temperature of $\approx 3 \text{ eV}$ ⁶³,

51.) the observation that microwave helium-hydrogen and argon-hydrogen plasmas showed average electron temperatures that were high, $30,500 \pm 5\% \text{ K}$ and $13,700 \pm 5\% \text{ K}$, respectively; whereas, the corresponding temperatures of helium and argon alone were only $7400 \pm 5\% \text{ K}$ and $5700 \pm 5\% \text{ K}$, respectively⁶⁴,

52.) the observation of significant Balmer α line broadening of 17, 9, 11, 14, and 24 eV from rt-plasmas of incandescently heated hydrogen with K^+ / K^+ , Rb^+ , cesium, strontium, and strontium with Ar^+ catalysts, respectively, wherein the results could not be explained by Stark or thermal broadening or electric field acceleration of charged species since the measured field of the incandescent heater was extremely weak, 1 V/cm, corresponding to a broadening of much less than 1 eV ⁶⁵,

53.) calorimetric measurement of excess power of 20 mW/cc on rt-plasmas formed by heating hydrogen with K^+ / K^+ and Ar^+ as catalysts⁶⁶,

54.) the observation of rt-plasmas formed with strontium and argon at 1% of the theoretical or prior known voltage requirement with a light output per unit power input up to 8600 times that of the control standard light source as well as an excess power of 20 mW/cm from rt-plasmas formed by Ar^+ as the catalyst in an incandescent-filament cell⁶⁷,

⁶² Reference Nos. 16, 20, 30, 52, 72

⁶³ Reference Nos. 33-37, 43, 49, 60, 63, 64, 69, 71, 73, 74, 82, 84, 88

⁶⁴ Reference Nos. 34-37, 43, 49, 63, 67, 73

⁶⁵ Reference Nos. 39, 42, 46, 51, 52, 54, 55, 57, 72, 81, 89, 91

⁶⁶ Reference Nos. 39, 81, 89

⁶⁷ Reference No. 72

55.) the Calvet calorimetry measurement of an energy balance of over $-151,000 \text{ kJ/mole } H_2$ with the addition of 3% hydrogen to a plasma of argon having the catalyst Ar^+ compared to the enthalpy of combustion of hydrogen of $-241.8 \text{ kJ/mole } H_2$; whereas, under identical conditions no change in the Calvet voltage was observed when hydrogen was added to a plasma of noncatalyst xenon⁶⁸,

56.) the observation that the power output exceeded the power supplied to hydrogen glow discharge plasmas by 35-184 W depending on the presence of catalysts from helium or argon and less than 1% partial pressure of strontium metal in noble gas-hydrogen mixtures; whereas, the chemically similar noncatalyst krypton had no effect on the power balance⁶⁹,

57.) the observation that with the addition of 3% flowing hydrogen to an argon microwave plasma with a constant input power of 40 W, the gas temperature increased from 400°C to over 750°C; whereas, the 400°C temperature of a xenon plasma run under identical conditions was essentially unchanged with the addition of hydrogen⁷⁰,

58.) observations of power such as that where the addition of 10% hydrogen to a helium microwave plasma maintained with a constant microwave input power of 40 W, the thermal output power was measured to be at least 280 W corresponding to a reactor temperature rise from room temperature to 1200°C within 150 seconds, a power density of 28 MW/m^3 , and an energy balance of at least $-4 \times 10^5 \text{ kJ/mole } H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8 \text{ kJ/mole } H_2$ ⁷¹,

59.) the observation of $306 \pm 5 \text{ W}$ of excess power generated in 45 cm^3 by a compound-hollow-cathode-glow discharge of a neon-hydrogen (99.5/0.5%) mixture corresponding to a power density of 6.8 MW/m^3 and an energy balance of at least $-1 \times 10^6 \text{ kJ/mole } H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8 \text{ kJ/mole } H_2$ ⁷²,

⁶⁸ Reference No. 31

⁶⁹ Reference No. 30

⁷⁰ Reference No. 43

⁷¹ Reference Nos. 34, 35

⁷² Reference Nos. 50, 78

60.) the observation that for an input of 37.7 W, the total plasma power of the neon-hydrogen plasma measured by water bath calorimetry was 60.7 W corresponding to 23.0 W of excess power in 3 cm^3 ⁷³,

61.) the observation of intense He^+ emission and a total plasma power of a helium-hydrogen plasma measured by water bath calorimetry of 30.0 W for an input of 8.1 W, corresponding to 21.9 W of excess power in 3 cm^3 wherein the excess power density and energy balance were high, 7.3 W/cm^3 and $-2.9 \times 10^4\text{ kJ/mole H}_2$, respectively⁷⁴,

62.) in the comparison of helium-hydrogen plasmas sources, the observation that i.) with an input power of $24.8 \pm 1\text{ W}$, the total plasma power of the Evenson microwave helium-hydrogen plasma measured by water bath calorimetry was $49.1 \pm 1\text{ W}$ corresponding to $24.3 \pm 1\text{ W}$ of excess power in 3 cm^3 corresponding to a high excess power density and energy balance of 8.1 W/cm^3 and over $-3 \times 10^4\text{ kJ/mole H}_2$, respectively, ii.) with an input of 500 W, a total power of 623 W was generated in a 45 cm^3 compound-hollow-cathode-glow discharge, iii.) less than 10% excess power was observed from inductively coupled RF helium-hydrogen plasmas, and iv.) no measurable heat was observed from MKS/Astex microwave helium-hydrogen plasmas that corresponded to the absence of H Balmer line broadening⁷⁵,

63.) the observation of energy balances of helium-hydrogen microwave plasmas of over 100 times the combustion of hydrogen and power densities greater than 10 W/cm^3 measured by water bath calorimetry⁷⁶,

64.) at the load matching condition of $600\ \Omega$, the direct plasmadynamic conversion (PDC) of open circuit voltages of 11.5 V and ~200 mW of electrical power with a 0.125 in diameter by 3/4 in long plasmadynamic electrode and a 140 G applied field corresponding to an extracted power density of $\sim 1.61\text{ W/cm}^3$ and an efficiency of ~18.8%⁷⁷,

⁷³ Reference No. 76

⁷⁴ Reference Nos. 36, 63, 71, 73

⁷⁵ Reference Nos. 84, 98, 104

⁷⁶ Reference Nos. 34-36, 50, 63, 71, 73, 76-78, 84, 92, 93, 101

⁷⁷ Reference No. 48

65.) at the load matching condition of $250\ \Omega$, the direct plasmadynamic conversion (PDC) of open circuit voltages of 21.8 V and 1.87 W of electrical power with a 0.125 in diameter by 3/4 in long plasmadynamic electrode and a 140 G applied field corresponding to an extracted power density of $3.6\ \text{W}/\text{cm}^3$ and an efficiency of 42%⁷⁸,

66.) the projection that the generation of electricity using magnetohydrodynamic (MHD) conversion of the plasma particle energy of small to mid-size chemically assisted microwave or glow discharge plasma (ca-plasma) power sources in the range of a few hundred Watts to several 10's of kW for microdistributed commercial applications appears feasible at 50% efficiency or better with a simple compact design⁷⁹,

67.) the differential scanning calorimetry (DSC) measurement of minimum heats of formation of *KHI* by the catalytic reaction of *K* with atomic hydrogen and *KI* that were over $-2000\ \text{kJ}/\text{mole}\ H_2$ compared to the enthalpy of combustion of hydrogen of $-241.8\ \text{kJ}/\text{mole}\ H_2$ ⁸⁰,

68.) the isolation of novel hydrogen compounds as products of the reaction of atomic hydrogen with atoms and ions which formed an anomalous plasma as reported in the EUV studies⁸¹,

69.) the synthesis and identification of a novel diamond-like carbon film terminated with $CH(1/p)$ (H^*DLC) comprising high binding energy hydride ions was synthesized for the first time from solid carbon by a microwave plasma reaction of a mixture of 10-30% hydrogen and 90-70% helium wherein He^+ served as a catalyst with atomic hydrogen to form the highly stable hydride ions and an energetic plasma⁸²,

70.) the synthesis of polycrystalline diamond films on silicon substrates without diamond seeding by a very low power microwave plasma reaction of a mixture of helium-hydrogen-methane (48.2/48.2/3.6%) wherein He^+ served as a catalyst with atomic hydrogen to form an energetic plasma with an average hydrogen atom temperature of 180 - 210 eV versus $\approx 3\ \text{eV}$ for pure hydrogen and bombardment of the

⁷⁸ Reference No. 56

⁷⁹ Reference No. 40

⁸⁰ Reference No. 25

⁸¹ Reference Nos. 6-10, 19, 25, 38, 41, 44, 45, 60-62, 75, 81, 87, 90, 92, 93, 100, 101

⁸² Reference No. 60

carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond⁸³,

71.) the synthesis of polycrystalline diamond films on silicon substrates without diamond seeding by a very low power microwave plasma reaction of a mixture of argon-hydrogen-methane (17.5/80/2.5%) wherein Ar^+ served as a catalyst with atomic hydrogen to form an energetic plasma with an average hydrogen atom temperature of 110 - 130 eV versus ≈ 3 eV for pure hydrogen and bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond⁸⁴,

72.) the identification of a novel highly stable surface coating $SiH(1/p)$ by time of flight secondary ion mass spectroscopy that showed SiH^+ in the positive spectrum and H^- dominant in the negative spectrum and by X-ray photoelectron spectroscopy which showed that the H content of the SiH coatings was hydride ions, $H^-(1/4)$, $H^-(1/9)$, and $H^-(1/11)$ corresponding to peaks at 11, 43, and 55 eV, respectively, and showed that the surface was remarkably stable to air⁸⁵,

73.) the isolation of novel inorganic hydride compounds such as $KHKHCO_3$ and KH following each of the electrolysis and plasma electrolysis of a K_2CO_3 electrolyte which comprised high binding energy hydride ions that were stable in water with their identification by methods such as (i) ToF-SIMS on $KHKHCO_3$ which showed inorganic hydride clusters $K[KHKHCO_3]^+$ and a negative ToF-SIMS dominated by hydride ion, (ii) X-ray photoelectron spectroscopy which showed novel peaks corresponding to high binding energy hydride ions, and (iii) 1H nuclear magnetic resonance spectroscopy which showed upfield shifted peaks corresponding to more diamagnetic, high-binding-energy hydride ions⁸⁶,

74.) the identification of $LiHCl$ comprising a high binding energy hydride ion by time of flight secondary ion mass spectroscopy which showed a dominant H^- in the negative ion spectrum, X-ray photoelectron spectroscopy which showed $H^-(1/4)$ as a new peak at its predicted binding energy of 11 eV, 1H nuclear magnetic resonance

⁸³ Reference Nos. 64, 69, 88

⁸⁴ Reference Nos. 82, 88

⁸⁵ Reference Nos. 45, 61, 100

⁸⁶ Reference Nos. 6-7, 9, 38, 41

spectroscopy which showed an extraordinary upfield shifted peak of -15.4 ppm corresponding to the novel hydride ion, and powder X-ray diffraction which showed novel peaks⁸⁷,

75.) the identification of novel hydride compounds by a number of analytical methods such as (i) time of flight secondary ion mass spectroscopy which showed a dominant hydride ion in the negative ion spectrum, (ii) X-ray photoelectron spectroscopy which showed novel hydride peaks and significant shifts of the core levels of the primary elements bound to the novel hydride ions, (iii) 1H nuclear magnetic resonance spectroscopy (NMR) which showed extraordinary upfield chemical shifts compared to the NMR of the corresponding ordinary hydrides, and (iv) thermal decomposition with analysis by gas chromatography, and mass spectroscopy which identified the compounds as hydrides⁸⁸,

76.) the NMR identification of novel hydride compounds MH^*X wherein M is the alkali or alkaline earth metal, X , is a halide, and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance⁸⁹,

77.) the replication of the NMR results of the identification of novel hydride compounds by large distinct upfield resonances at Spectral Data Services, University of Massachusetts Amherst, University of Delaware, Grace Davison, and National Research Council of Canada⁹⁰,

78.) the NMR identification of novel hydride compounds MH^* and MH_2^* wherein M is the alkali or alkaline earth metal and H^* comprises a novel high binding energy hydride ion identified by a large distinct upfield resonance that proves the hydride ion is different from the hydride ion of the corresponding known compound of the same composition⁹¹,

79.) the observation that the 1H MAS NMR spectrum of novel compound KH^*Cl relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at

⁸⁷ Reference Nos. 44, 62

⁸⁸ Reference Nos. 6-10, 19, 25, 38, 41, 44, 45, 60-62, 75, 81, 87, 90, 92, 93, 100

⁸⁹ Reference Nos. 10, 19, 41, 44, 62, 81

⁹⁰ Reference Nos. 19, 81

⁹¹ Reference Nos. 19, 81

-4.4 corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $p = 4$, and the novel peak of KH^*I at -1.5 ppm relative to TMS corresponding to an absolute resonance shift of -33.0 ppm matched the theoretical prediction of $p = 2$ ⁹²,

80.) the observation that the predicted catalyst reactions, position of the upfield-shifted NMR peaks, and spectroscopic data for $H^-(1/2)$ and $H^-(1/4)$ were found to be in agreement⁹³,

81.) the isolation of fraction-principal-quantum-level molecular hydrogen $H_2(1/p)$ gas by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap, and the observations of novel peaks by cryogenic gas chromatography, a higher ionization energy than H_2 by mass spectroscopy, a substantial change in the EUV emission spectrum with deuterium substitution in a region where no hydrogen emission has ever been observed, and upfield shifted NMR peaks at 0.21, 2.18 and 3.47 ppm compared to that of H_2 at 4.63 ppm⁹⁴,

82.) the observation of 1H NMR singlet peaks upfield of H_2 with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm identified as the consecutive series $H_2(1/2)$, $H_2(1/3)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively, and $H_2(1/10)$ at -1.8 ppm wherein $H_2(1/p)$ gas was isolated by liquefaction at liquid nitrogen temperature, by decomposition of compounds found to contain the corresponding hydride ions $H^-(1/p)$, and by permeation through a hollow nickel cathode⁹⁵.

83.) the observation of excess enthalpy from a K_2CO_3 electrolytic cell of a factor of two times that of the resistive power dissipation and 1H NMR singlet peaks upfield of H_2 with a predicted integer spacing of 0.64 ppm at 3.49, 2.17, 1.25, 0.86, and 0.21 ppm which matched the consecutive series $H_2(1/2)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively, and a higher ionizing molecular hydrogen recorded on the electrolysis gases collected in a hollow nickel cathode⁹⁶.

⁹² Reference No. 81

⁹³ Reference No. 81

⁹⁴ Reference Nos. 75, 87, 90, 92, 93, 94, 101

⁹⁵ Reference Nos. 98, 101, 103, 104

⁹⁶ Reference Nos. 103, 104

Applicant again respectfully demands that the Secret Committee consider and evaluate in detail all of this record evidence, which, to date, it has largely ignored. The scientific data disclosed in this extensive body of evidence was collected and peer-reviewed with great care by a group of highly qualified scientists capable of understanding every detail of Applicant's technology. The very least the Committee can do is to also carefully evaluate that data in detail, article by article, with an open mind, so that Applicant is given a full and fair opportunity to present his case. If and when the Committee finally does so, Applicant believes it will find that the evidence overwhelmingly proves the existence of lower-energy hydrogen in accordance with his disclosed invention.

If, on the other hand, the Committee should find true fault with any of that data on legitimate scientific grounds—not the kind of nitpicking Applicant has seen on theoretical grounds—it should communicate as much to afford Applicant the opportunity to respond. Such scientific give-and-take is the only way to advance the prosecution of this case.

Unfortunately, with continued prosecution of this and BlackLight's other applications, a far different pattern has emerged. The Committee continues to set arbitrary and capricious hurdles designed to avoid considering Applicant's conclusive experimental evidence and thereby block his patents from issuing. Each time Applicant clears one of these hurdles, the Committee merely raises the bar by setting new standards.

For instance, the Committee initially alleged that Applicant's disclosed hydrogen chemistry, which forms lower-energy hydrogen, related to the controversial concepts of "perpetual motion" and "cold fusion." When Applicant exposed those allegations as utter nonsense, the Committee quickly abandoned its indefensible position, arguing instead that BlackLight's lower-energy hydrogen technology violated unidentified laws of physics. Then, to cover up its failure to identify even a single physical law that was supposedly being violated, the Committee improperly placed the burden on Applicant to do so: "in order to establish enablement, applicant bears the burden of providing the accepted scientific laws wrong or incomplete." When Applicant showed just the opposite is true—that Applicant's novel hydrogen chemistry complies with all physical

laws, even at atomic and sub-atomic levels—the Committee once again backpedaled. The Committee then advanced vague assertions that Applicant's lower-energy hydrogen violated "ideas" of modern science and, later, that his technology contradicted "beliefs" in the scientific community.

The only consistency found throughout this myriad of contrived standards is the Committee's use of each to excuse it from fairly considering and evaluating Applicant's scientific evidence that lower-energy hydrogen does indeed exist. Instead, the Committee prefers engaging in a theoretical debate to the exclusion of that evidence, pitting its favored quantum theory, with all of its far-fetched and disproved predictions, against Applicant's theory of classical quantum mechanics that correctly predicts the formation of lower-energy hydrogen.

Applicant has willingly engaged the Committee in this debate, and will continue to do so if necessary, even though the patent laws do not require that an inventor understand the precise theoretical basis for why his invention works. All the law requires is that he disclose his invention in sufficient detail to enable one of ordinary skill in the art how to practice it. Applicant has done precisely that and the Committee has failed in its burden to show otherwise.

Of course, the debate over these competing theories can go on indefinitely without resolution, which may be the Committee's strategy. Engaging in that intellectual exercise, however, will not—indeed cannot—definitively settle the question of whether practicing Applicant's disclosed hydrogen chemistry results in the formation of lower-energy hydrogen. Like any good theoretical debate, this one can only be tested and ultimately settled by fairly analyzing the unprecedented amount of experimental evidence Applicant has submitted conclusively confirming the lower energy states of hydrogen.

Applicant has expended tens of millions of dollars amassing this experimental evidence. The least the Committee can do is properly consider it. The Committee's view, however, appears to be that, because the existence of lower-energy hydrogen is theoretically impossible—at least according to its misguided view of quantum mechanics—it need not seriously analyze any contrary evidence. Applicant is hard

pressed to imagine an approach to patent examination any more arbitrary and capricious than that.

In the few isolated instances in which the Committee does address Applicant's evidence, it comes up with far-fetched reasons for dismissing it without a fair hearing, again demonstrating its arbitrary and capricious approach to examination of this case. One prominent example occurred during the February 21, 2001 Interview of this and other BlackLight applications, which was led by Examiner Vasudevan Jagannathan—one of the few Committee members Applicant has been able to successfully identify. At that interview, Applicant had a brief opportunity to present some of his scientific evidence, including spectroscopic data that is extraordinarily reliable in analyzing chemical compositions. Such data amounts to a "chemical fingerprint" that cannot be seriously disputed. Despite the conclusiveness of that evidence, Examiner Jagannathan dismissed it out of hand as nothing more than "a bunch of squiggly lines."

To put the absurdity of that comment in context, the PTO rationalized its withdrawal of BlackLight's five allowed patent applications, in part, by citing a January 12, 2000 article written by Dr. Robert Park, spokesman for one of Applicant's main competitors, the American Physical Society (APS). [March 22, 2000 Decision at page 7 (Attachment G)] In that article, Dr. Park made the following startling statement:

The energy states of atoms are studied through their atomic spectra—light emitted at very specific wavelengths when electrons make a jump from one energy level to another. The exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory; it is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line.

There is no line corresponding to a "hydrino" state. Indeed there is no credible evidence at all to support Mills' claim. [See Attachment J (emphasis added)]

The incredible irony here—one that cannot be easily overlooked—highlights once again the extreme arbitrary and capricious approach the Committee has taken in examining this and other BlackLight applications. There is no question that the vitriol espoused by Dr. Park in his cited *Post* article was, at least, partially responsible for the PTO's suspect withdrawal of the five allowed BlackLight applications from issue. And

yet, despite the fact that the very article the PTO relies upon to deny Applicant his patents recognizes that spectroscopic data is extraordinarily reliable—indeed, the “platform on which our entire understanding of atomic physics is built”—the Committee nonetheless continues to cavalierly ignore or dismiss that same data when submitted by Applicant.

Out of exasperation, Applicant queried Examiner Jagannathan during the February 21 Interview as to what type and quality of evidence would convince him that lower-energy hydrogen exists. In response, the Examiner required that Applicant publish his experimental evidence in peer-reviewed scientific journals for that evidence to be considered reliable. As detailed above, Applicant has more than met this newly created “publication” standard for considering his experimental evidence by submitting over 100 scientific papers for publication, even though the PTO’s rules and procedures impose no such requirement. So far, over 50 of these papers have completed and passed the peer-review process conducted by highly qualified Ph.D. referees.

The esteemed list of journals to which Applicant’s experimental evidence has been extensively peer-reviewed and published includes:

- Applied Physics Letters
- Chemistry of Materials
- Electrochimica Acta
- Fusion Technology
- IEEE Transactions on Plasma Science
- International Journal of Hydrogen Energy
- Journal of Applied Physics
- Journal of Molecular Structure
- Journal of Plasma Physics
- Journal of Quantitative Spectroscopy and Radiative Transfer,
- Journal of Physics D: Applied Physics
- Journal of New Materials for Electrochemical Systems
- New Journal of Physics
- Plasma Sources Science and Technology
- Solar Energy Materials & Solar Cells
- Thermochimica Acta
- Vibrational Spectroscopy

The esteemed list of journals to which Applicant's experimental evidence has been submitted for publication includes:

Acta Physica Polonica A
AIAA Journal
Annales De La Foundation Louis DeBroglie
Brazilian Journal of Physics
Canadian Journal of Physics
Central European Journal of Physics
Contributions to Plasma Physics
Current Applied Physics
Doklady Chemistry
European Journal of Physics D
European Physical Journal: Applied Physics
Europhysics Letters
Foundations of Physics
Frizika A
International Journal of Theoretical Physics
Journal of Applied Physics
Journal of Applied Spectroscopy
Journal of Electroanalytical Chemistry
Journal of Material Science
Journal of the Physical Society of Japan
Journal of Physical Chemistry A
Journal of Physical Chemistry B
Journal of Plasma Physics
Journal of Quantitative Spectroscopy and Radiative Transfer
Journal of Vacuum Science & Technology A
Materials Characterization
Materials Chemistry and Physics
Materials Science
New Journal of Chemistry
Physica B
Physics Essays
Physics of Plasmas

Spectrochemica Acta Part B: Atomic Spectroscopy
Technical Physics
Thin Solid Films
Vacuum

Once again, however, the Secret Committee has raised the bar to patentability by arbitrarily and capriciously ignoring this vast body of evidence that it required Applicant to submit. The Committee apparently believes that its anonymous members are better qualified than the numerous skilled PhD's who peer-reviewed and approved Applicant's articles confirming the existence of lower-energy hydrogen.

The PTO's mishandling of the experimental evidence of record in this case is but one of several improper actions that have adversely effected Applicant's patent rights. Others include:

- (1) illegally withdrawing or threatening to withdraw other copending BlackLight patent applications from issue, after initially allowing all claims, under highly suspicious circumstances that suggest possible interference by BlackLight's competitors;
- (2) improperly examining this application by Secret Committee, effectively denying Applicant the right to confront the persons involved in that examination and access their qualifications, and to ascertain whether those persons include BlackLight's competitors, or other improper outside influences, in breach of PTO confidentiality requirements; and
- (3) refusing reasonable requests by Applicant and five U.S. Senators to divulge information relating to the events that triggered the PTO's withdrawal action, and the identity of all PTO employees and non-PTO personnel involved in examining BlackLight's applications.

These improper actions bear directly upon the prosecution of BlackLight's pending applications, yet Applicant's good faith efforts to discuss and resolve these and other outstanding issues have been either ignored or rejected out of hand. One of Applicant's overtures was communicated directly to then PTO Director James E. Rogan in a letter dated December 21, 2001, from BlackLight board member Dr. Shelby T. Brewer. Dr. Brewer received his Ph.D. in Nuclear Engineering from M.I.T. and served as Assistant Energy Secretary in the Reagan administration. [See Attachment A]

As stated in his letter, Dr. Brewer's reasons for appealing to Director Rogan were motivated not only by his fiduciary duty to protect BlackLight's best interests, but also by a sincere desire to avoid unnecessary embarrassment to the PTO over these lingering issues if left unresolved. Dr. Brewer appealed for a meeting with Director Rogan in an attempt to bring some closure to this matter in a way that might mutually benefit both sides.

Despite the urgency of his plea, Dr. Brewer waited over four months before finally receiving a response to his request for a meeting. In a curt letter dated April 24, 2002, from the Director's Chief-of-Staff, Jason C. Roe, the PTO advised: "We appreciate your interest in this matter, but, unfortunately, must decline your request for a meeting due to the fact that the USPTO is not in a position to discuss the issue at the present time." [See Attachment A]

This negative response, while disappointing, was hardly surprising. In refusing to meet with Applicant, the PTO continues to treat prosecution of this and BlackLight's other copending cases as an adversarial proceeding. While the PTO may believe it is justified in shrouding its untoward actions under a cloak of secrecy and remaining answerable to no one, that approach does little to preserve public confidence in the patent process. Only by openly engaging Applicant in mutually beneficial discussions of all the issues in this case can the PTO ever hope to achieve that worthy goal. Applicant therefore implored Director Rogan to reconsider his decision and adopt a more flexible and cooperative approach by agreeing to meet with Applicant to discuss the handling of this and other pending BlackLight applications before taking any further action.

Perhaps the PTO sees no need to modify its approach, buoyed by the Federal Circuit's June 28, 2002 Decision upholding its withdrawal action that cancelled issuance of BlackLight's allowed patent applications. See *BlackLight Power, Inc. v. Director James E. Rogan*, 63 USPQ2d1534 (Fed. Cir. June 28, 2002) [See Attachment B]. The Federal Circuit ruled, among other things, that an "emergency situation" trumped the controlling regulation requiring the PTO to determine the unpatentability of one or more claims before it withdrew the '294 application from issue so that the PTO's mere "concern" over patentability provided adequate basis for the withdrawal. That Decision,

aside from the fact that it is erroneous,⁹⁷ does not even begin to resolve other issues that touch on the merits of this case.

One such issue is how this alleged "emergency situation" arose in the first place, *i.e.*, how the PTO became aware of BlackLight's issued U.S. Patent No. 6,024,935 (the '935 patent) that supposedly raised "concerns" about other pending applications. That issue apparently was not important to Associate Solicitor Kevin Baer who defended the PTO's conduct by arguing to the District Court: "I would even say, Your Honor, you could imagine in our head any scenario of how we learned about it. A blimp flying over us. It doesn't matter, because what matters, Your Honor, is the decision [to withdraw] itself." [May 22, 2000 Transcript at 22 (Attachment K, Tab E)]

Judge Sullivan, however, was apparently unimpressed by those comments, noting in footnote 10 of his opinion that he was "troubled by several steps in the PTO's process" and advising the PTO to "examine its patent issuance process so that their normal operations are not compromised by such seemingly suspicious procedures." [See 109 F.Supp. 2d at 53 (See Attachment L)]

⁹⁷ Applicant believes that the Federal Court's opinion is erroneous due, in part, to its misreading of a concurring opinion of one Justice in a 38-year-old Supreme Court case to support its holding that this supposed "emergency situation"—a finding that was not supported by the record or even argued by the PTO—justified the PTO's withdrawing BlackLight's copending '294 application from issue on February 17, 2000, after payment of the issue fee. See *BlackLight Power* at page 7 citing *Baltimore & Ohio Railroad Co. v. United States*, 386 U.S. 372, 421 (1964) (Brennan, J., concurring) (recognizing the importance of leaving the Interstate Commerce Commission (ICC) great flexibility to deal with emergency situations to avoid serious damage to the national transportation system, but finding no pressing need that justified the ICC's action). The Federal Circuit stretched that case way beyond the limits of Supreme Court precedent that requires government agencies to strictly follow statutory and regulatory guidelines.

Incredibly, at oral argument, the PTO did not even suggest that an emergency situation had forced it to withdraw this application from issue on February 17, 2000. To the contrary, PTO Solicitor John M. Whealan argued that no withdrawal—emergency or otherwise—occurred on that date and admitted that, if the Court found otherwise, his case would be seriously compromised. This was because, at that time, the PTO could not locate the patent file and admittedly could not have made a determination of unpatentability of one or more claims as required by the controlling regulation. See 37 C.F.R. § 1.131(b)(3); MPEP § 1308 (7th Ed., Rev. 1, Feb. 2000). To avoid an adverse ruling, Solicitor Whealan sought refuge outside the administrative record, suggesting for the first time that the PTO had used the wrong form in mistakenly notifying Applicant on February 17 that his application had been withdrawn. Then, again without evidentiary support, the Solicitor tried to convince a skeptical Court that Director Kepplinger, in consultation with the Examiner, had made an unpatentability determination sometime later, after Applicant had voluntarily supplied the PTO with a copy of the application—hardly an emergency situation if it were true.

While the PTO may be unconcerned how it learned of the '935 patent, Applicant considers that information critically important. If, for instance, competitors were somehow involved in events leading to the withdrawal of BlackLight's allowed applications and, perhaps, in the subsequent prosecution of those and other applications, that information would relate directly to the credibility of the rejections entered in those cases, including this one. Applicant therefore renews his request for a full accounting of how, out of the thousands of patents the PTO issues every week, his '935 patent came to its attention, thus leading to the withdrawal of BlackLight's allowed applications.⁹⁸

Applicant believes that concerns over outside influences on the prosecution of his applications are fully justified. Following the PTO's withdrawal action, counsel immediately investigated the facts and circumstances surrounding that action by questioning various PTO personnel. In discussions with Director Esther Kepplinger, she admitted to counsel that the withdrawal was a reaction to perceived heat—a "firestorm" as she put it—the PTO had received from an undisclosed outside source. Director Kepplinger further indicated that the withdrawal occurred only after BlackLight's '935 patent had been brought to the attention of then-Director Q. Todd Dickinson by Gregory Aharonian, another PTO outsider well known for publicly attacking issued U.S. patents.

Director Kepplinger's revelations are truly disturbing in that they describe what is, in essence, a newly created non-statutory reexamination procedure for opposing the issuance of patents never envisioned by Congress. *Compare* 35 U.S.C. §§ 301-307 (patent reexamination statutes).

This was but one of several issues Dr. Brewer raised in his letter to Director Rogan as a possible topic for discussion that the PTO says it is "not in a position to discuss . . . at the present time." The PTO's response, however, merely begs the question: if not now, when?

Following the PTO's drastic withdrawal action, Applicant discovered other reliable information suggesting outside interference with BlackLight's patent applications and

⁹⁸ See Applicant's February 28, 2000 letter to Director Kepplinger documenting telephone and personal conversations between her and Applicant's counsel regarding improper outside influence that precipitated the withdrawal of BlackLight's five allowed applications. The PTO cited this letter in its March 22, 2000 Decision affirming its withdrawal action. [See Attachment G]

breaches of the PTO's duty to maintain the confidentiality of those applications. Applicant learned that Dr. Peter Zimmerman, former Chief Scientist for the State Department, had published an Abstract of an upcoming speech to the American Physical Society (APS)—a BlackLight competitor—boasting that his Department and the Patent Office “have fought back with success” against BlackLight. [See Attachment K, Tab C] In conversations with BlackLight's counsel, Dr. Zimmerman admitted that he had received information concerning BlackLight's applications through e-mails from Dr. Robert Park, spokesman for the APS, who told him of a contact in the PTO referred to by Dr. Park as “Deep Throat” with access to confidential patent information. [See Attachment K, Tab C]

An *APS News Online* bulletin, dated September 2002, suggests that Dr. Park is maintaining his questionable PTO contacts, apparently with the agency's blessing:

APS E-Board Passes Resolution on Perpetual Motion Machines

The APS Executive Board approved a resolution at its June 2002 meeting in Annapolis, MD, affirming the fraudulent nature of claims of perpetual motion machines.

The resolution was deemed necessary because of a recent increase in patent applications for such devices. Robert Park, APS Director of Public Information and author of the weekly electronic newsletter, “What's New,” reported that the US Patent Office has received several patent applications for perpetual motion machines during the first six months of this year alone. [Park's 2000 book, *Voodoo Science*, devoted considerable space to the phenomenon of such devices throughout history.] The text of the APS resolution follows.

The Executive Board of the American Physical Society is concerned that in this period of unprecedented scientific advance, misguided or fraudulent claims of perpetual motion machines and other sources of unlimited free energy are proliferating. Such devices directly violate the most fundamental laws of nature, laws that have guided the scientific progress that is transforming our world.

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[Attachment Q (emphasis added)] Dr. Park's knowledge of the number of pending patent applications filed in the PTO directed to a particular subject matter—information that is supposedly kept confidential—raises additional questions as to his activities in interfering with the prosecution of U.S. patent applications.⁹⁹

Of course, this should come as no surprise since Dr. Park has basically admitted his direct involvement in BlackLight's patent affairs, as evidenced by the September 6, 2002 issue of *What's New* he authored and published on the APS website:

The status of BlackLight Power's intellectual property is fuzzier than ever. BLP was awarded Patent 6,024,935 for "Lower-Energy Hydrogen Methods and Structures," a process for getting hydrogen atoms into a "state below the ground state". . . . You might expect these shrunken hydrogen atoms, called "hydrinos," to have a pretty special chemistry. Do they ever! Indeed, a second patent application titled "Hydride Compounds" had been assigned a number and BLP had paid the fee. Several other patents were in the works. That's when things started heading South. Prompted by an outside inquiry (who would do such a thing?), the patent director became concerned that this hydrino stuff required the orbital electron to behave "contrary to the known laws of physics and chemistry." The Hydride Compounds application [the '294 application] was withdrawn for further review and the other patent applications were rejected. [September 6, 2002 Online Newsletter of Dr. R. Park, *What's New* (Attachment C) (emphasis added)]

Dr. Park's startling admission was confirmed two weeks later in the September 20, 2002 issue of the *Online Newsletter* published by the James Randi Educational Foundation (JREF). In it, James Randi gleefully boasted about Dr. Park's contacting the Patent Office with the express purpose of sabotaging Applicant's patent rights:

But why, hard on the heels of re-examining other questionable patents (see three weeks ago on this page), would the Patent Office have happened upon this particular one [BlackLight's withdrawn '294 application], when there are so many in this category? The secret can be inferred from Bob Park's weekly column, where we find: "Prompted by an outside inquiry (who would do such a thing?) . . ." That rascal!

The very fact that the Patent Office has paid heed to the complaints that Park, the JREF, and others have made, speaks well for rationality. Let's hope that we can look forward to many quack devices and systems being re-evaluated. Let's see a lot more of this "extraordinary action" from the Director. As for BlackLight

⁹⁹ Not coincidentally, the Committee initially attacked the operability of Applicant's invention by mischaracterizing it as a "perpetual motion machine" and, therefore, *per se* unpatentable. The Committee quickly withdrew that line of attack as Applicant showed it was completely lacking in any merit.

Power, says Park, "Their long-awaited IPO may have to wait a little longer."
[September 20, 2002 Online Newsletter of the JREF, *Swift* (Attachment C)
(emphasis added)]

Despite all of this overwhelming incriminating evidence of improper outside interference by competitors with an administrative patent proceeding, the PTO prefers to ignore this matter. Apparently, this is not the first time that these same players—Dr. Park, James Randi and PTO officials—have been embroiled in a patent controversy such as this one involving improper interference with a patent proceeding. Less than a year before Applicant's five allowed applications were withdrawn from issue in February 2000, the PTO was caught up in another scandal of sorts involving the issuance of U.S. Patent Nos. 5,748,088 and 6,011,476, granted on a device that can identify the obscured location of living entities. Following issuance of the '088 patent, Dr. Park published in his *What's New* newsletter inaccurate, disparaging remarks, which were picked up by James Randi on his JREF website, concerning the operation and reliability of the claimed invention. An article published in *Science Magazine* during the pendency of the '476 patent also reported on the controversy and the involvement of Sandia National Labs (SNL) in the testing of the device. [Attachment D] That involvement and the disclosure of confidential information to David Voss, author of the *Science* article, was itself the subject of some controversy and resulted in the issuance of an internal PTO memorandum that was placed in the '476 patent file.

In that memorandum, the PTO felt compelled to reiterate its policy forbidding PTO employees from making public disclosures concerning pending patent applications:

PTO MEMORANDUM FOR ALL EMPLOYEES: MEDIA CONTACT POLICY

Posted Date: 06/25/99
Removal Date: 07/06/99

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER OF PATENTS AND
TRADEMARKS

Washington, D.C. 20231

June 22, 1999

99-42

MEMORANDUM FOR All Employees

FROM: Acting Assistant Secretary of Commerce and Acting
Commissioner of Patents and Trademarks

SUBJECT: Media Contact Policy

Since a memorandum on this subject was first issued several years ago, thousands of new employees have joined the PTO. Therefore, it is a good time to reiterate PTO policy concerning employee contact with members of the media including, but not limited to, those in print, broadcast, cable, and online publications.

All requests, including telephone and e-mail, from members of the media for interviews, tours, and appearances should be directed to the Office of Public Affairs (Richard Maulsby or Brigid Quinn). Public Affairs will then determine the appropriate Office response for such requests and arrange for all interviews and any other meetings with the media. A member of the Public Affairs staff may attend interviews and meetings.

This policy applies only to contact with the media, not to interactions with customers. Any questions about media contact should be directed to the Office of Public Affairs at 305-8341.

Additionally, MPEP section 1701 and TMEP section 1801 specify that Office personnel should not comment on the validity or enforceability of any U.S. patent or trademark registration. These sections also caution employees about answering other particular inquiries concerning U.S. patents or trademark registrations. Any questions on this policy should be directed to your supervisor or to the MPEP Editor at 305-8813 for patents or to the Office of the Assistant Commissioner for Trademarks at 308-8900. [Attachment E]

Curiously, SNL is where Dr. Park previously served as head of its Surface Physics Division, leading Applicant to wonder whether SNL, or any of its sister labs, have had any similar involvement in the examination of this and other BlackLight applications. Applicant's curiosity on this point is further heightened by the fact that Examiner Bernard Eng-Kie Souw, a former employee with Brookhaven National Labs,

has been engaged in the examination of BlackLight's patent applications for some time now. [See, e.g., Appn. Ser. No. 09/513,768] As discussed below, Examiner Souw's present activities as lead scientist for a company he owns in competition with BlackLight has also raised genuine conflicts of interest, adding further cause for concern.

If, as Applicant suspects, the PTO has conferred with others having ties to the APS, like Dr. Park or Dr. Zimmerman, or to other BlackLight competitors in withdrawing or rejecting BlackLight's applications, that information would be highly relevant and thus must be disclosed. Clearly, knowing the identity and potential biases of all persons providing input or otherwise involved in rejecting BlackLight's applications, especially those with competing interests, bears directly on the credibility of those rejections.

Applicant has, on numerous occasions, disclosed to PTO officials information relating to Dr. Park's undermining of BlackLight's patent rights, as relayed in Dr. Brewer's December 21, 2001 letter to then PTO Director Rogan, only to be ignored. [Attachment A. See also, for example, January 19, 2001 Letter to Director Kepplinger (Attachment K)] As Dr. Brewer explained in his letter, BlackLight is obviously concerned, among other things, that the PTO, once again, may have breached its duty to maintain confidentiality of U.S. patent applications under 35 U.S.C. § 122, 18 U.S.C. § 2071, 37 C.F.R. § 1.14, and M.P.E.P. § 101. The PTO's curt statement that it is "not in a position to discuss the issue at the present time" does little to allay those concerns.

Dr. Brewer further expressed in his letter distress over the suspected compromise of Applicant's patent rights to his novel hydrogen chemistry by a group of physicists with a vested interest in maintaining federal funding for projects based on a competing scientific theory and that those physicists continue to exert improper influence on the prosecution of BlackLight's pending applications.

Those suspicions are only fueled by continued PTO silence on these issues while it undercuts Applicant's patent rights based on statements of competitors like Dr. Park. For instance, In its March 22, 2000 Decision, the PTO justified its withdrawal action by relying, in part, on a *Washington Post* article written by Dr. Park only slightly more than a month prior to the withdrawal:

While petitioner in the accompanying letter points to favorable testimonials from scientists and entrepreneurs regarding the "revolutionary

technology" that the instant application is asserted to embody, this does not establish that either the Director, Technology Center 1700, or the Director, Special Programs Law Office, committed reversible error, nor that the Notice should be withdrawn. In contrast, mainstream newspapers have reported this same "revolutionary technology" is accompanied by controversy in the scientific community. See Baard et al., Scientists and entrepreneurs have lots of ideas about new sources of energy; some may even be practical, Wall St. J., Sept. 13, 1999, at R16; **Park, Perpetual motion; still going around, Washington Post, Jan. 12, 2000, at H3.** [March 22 Decision at 7 (Attachment G)]

Applicant is naturally skeptical that this timing was simply a coincidence. Regardless, the mere fact that the PTO would rely on any competitor to "bad-mouth" BlackLight's technology is troubling. That it relied on Dr. Park of all people, known for conducting "hatchet jobs" on new technologies that threaten federal funding for the physicists he represents, is contemptible.

The same *Washington Post* that ran Dr. Park's libelous article rebuked its less than credible author in a subsequent article confirming his reputation for engaging in what it described a "search-and-destroy mission" against inventors and scientists who seek to advance the bounds of science. [See Article dated June 25, 2000 (Attachment M)] To quote the article's exact words, "Park's anger permeates his rebuttals, which border on character assassination." Noting that "thoroughness is not Park's strong suit," the article goes on to suggest that his intentions may be less than honorable:

Park's failure to gather first-hand data is unfortunate, but his selective omissions are far more serious. In at least one case, he violated basic principles of journalism and science itself by apparently suppressing information that conflicts with his foregone conclusion. . . . Such tactics are reminiscent of the behavior of a zealous DA who is so convinced that a suspect is guilty that he feels entitled to withhold some information from the jury.

Dr. Park's competitive motives in attacking BlackLight's novel hydrogen chemistry, and thereby undermining its patent rights, are clear, as further recognized by the *Post* article in its description of Dr. Park as "a Washington lobbyist and PR flack for the American Physical Society." The article goes on to warn of the serious effects a rush to judgment can have without first-hand review of experimental evidence:

This is a serious matter, since even poorly documented vitriol can jeopardize a scientist's reputation and future funding if it is disseminated with the complicity of a respected organization such as the American Physical Society.

Incredibly, in rationalizing its withdrawal action, the PTO pays tribute to a "hatchet man" like Dr. Park, who never lets scientific evidence interfere with sabotaging a competitor, by citing his hostile statements against BlackLight. Yet, in explaining the issuance of BlackLight's '935 patent, the PTO publicly denigrates its entire examining corps, known for their careful study of experimental evidence in deciding whether to issue U.S. patents:

[P]atent examiners do review [patent applications]. Unfortunately, patent examiners are swamped and sometimes things slip through. [Statement of Associate Solicitor Baer in *BlackLight Power, Inc. v. Q. Todd Dickinson*, May 22, 2000 Tr. at 7 (Attachment K, Tab A)]

[E]xaminers are under tremendous pressure to produce work, and if they're going to approve [an application], they just approve it and kind of let it out the door. [May 22, 2000 Tr. at 48 (Attachment K, Tab A)]

As Dr. Brewer pointed out in his letter to Director Rogan, the PTO, in making these outrageous public statements, undercuts the statutory presumption of validity that has attached to every issued U.S. patent for well over 50 years:

Presumption of validity; defenses

A patent shall be presumed valid. Each claim of a patent (whether in independent, dependent, or multiple dependent form) shall be presumed valid independently of the validity of other claims; dependent or multiple dependent claims shall be presumed valid even though dependent upon an invalid claim. The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting such invalidity.

Underlying this statutory presumption is the premise of administrative regularity, which presumes that well-trained examiners with expertise in their respective fields properly carry out their examination duties by issuing only valid patents. See, e.g., American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1359 (Fed. Cir. 1984). This presumption was, in fact, confirmed by the capable work of Examiners

Langel and Kalafut who, with over 50 years of experience between them, examined and allowed Applicant's '935 patent, along with BlackLight's withdrawn applications.¹⁰⁰

As succinctly stated in Dr. Brewer's letter, Solicitor Baer's statements on behalf of the PTO should be alarming to just about everyone, with the possible exception of accused patent infringers, and most certainly do not reflect well on an agency charged with maintaining the integrity of the patent system. Applicant felt that a meeting with Director Rogan to secure a retraction of those statements would be mutually beneficial to both sides. Yet once again, inexplicably, the PTO was not, and presumably is still not, prepared to discuss this issue.

These and other unfair assaults on Applicant's patent rights leave him to ponder: What would motivate the PTO to conduct itself with such total disregard for U.S. patent laws and regulations governing its administrative authority just to attack this one Applicant?

Applicant's fear is that these attacks may be attributable to competitors, like Dr. Park, who are coordinating an organized smear campaign to discredit BlackLight's technology. That fear is only heightened by the PTO's hiding behind strained theoretical arguments as an excuse for refusing to fairly evaluate Applicant's experimental evidence, while using its Secret Committee to issue anonymous rejections in this and other BlackLight applications. Dr. Brewer also brought these issues to Director Rogan's attention as an agenda item for a meeting that, unfortunately, has never taken place.

Applicant, however, has a right to know the identity and qualifications of all persons providing input to, or otherwise participating in, the examination process. This information bears directly on the credibility of the rejections that have been entered in this and other BlackLight applications. For instance, if Dr. Park or any of his physicist cronies have been consulted in denying Applicant his patent rights, it would certainly explain the arbitrary and capricious handling of the experimental evidence of record in those cases.

¹⁰⁰ The Examiners initially rejected all claims in these cases, but after conducting five lengthy personal interviews with Applicant and carefully considering Applicant's experimental evidence, they ultimately allowed those claims.

Particularly germane is the identity of those persons responsible for, or otherwise involved in, creating the Office Actions, Attachments, and Appendices that make up the record in this application and other BlackLight cases. To this day, the Committee has refused, without any adequate explanation, to provide this vital information to the detriment of Applicant.

Furthermore, Applicant is entitled to know which PTO officials are ultimately responsible for analyzing Applicant's scientific data evidencing the existence of lower-energy hydrogen, and which officials have the final authority to decide the fate of BlackLight's applications. The Committee's unfair refusal to divulge that information has also seriously handicapped Applicant's ability to effectively respond to and overcome the rejections of record.

For instance, Applicant has been stymied on numerous occasions in attempts to discover the basis for various positions articulated by the Committee, or the status of certain actions it has taken. Seldom are the Examiners of record, who are mere signatories to the Committee's handiwork, or their immediate supervisors, able to give any useful guidance on those subjects, either because they have no authority to do so and cannot divulge who does, or, in some cases, they do not know who even has custody of the patent file so as to investigate the answer to a particular question.

Knowing who is responsible for analyzing the record evidence would also allow Applicant to assess that person's qualifications, as compared to those Ph.D. scientists who have peer reviewed the published experimental evidence confirming lower energy states of hydrogen. Equally important, by knowing who has authority to issue BlackLight's applications, Applicant can more easily ascertain and satisfy the patentability standards being applied in rejecting claims to his novel hydrogen technology.

Illustrating this last point, Applicant attempted to force the Secret Committee to set reasonable standards by which his data could be accepted as reliable proof by requesting the personal Interview that was held on February 21, 2001. Of course, to effectively determine the standards being applied against Applicant, he first had to identify the person(s) responsible for setting those standards.

Applicant, however, was only partially successful in that effort. Prior to the February 21 Interview, Applicant's counsel uncovered the identity of only one Committee member, Examiner Vasu Jagannathan, who played a role in rejecting BlackLight's applications. Incredibly, Examiner Jagannathan initially denied any such involvement, accurately noting that his name did not appear anywhere in the record. He therefore refused counsel's explicit request that he attend the upcoming Interview. Only after counsel wrote to a high-level supervisor demanding that Examiner Jagannathan attend did counsel receive confirmation that the Examiner was "directly involved in the creation of the Office Action" to be discussed at the Interview and that he would indeed attend. [See January 19, 2001 letter to Director Esther Kepplinger (Attachment K) and February 12, 2001 Letter from Director Jacqueline M. Stone (Attachment N)]

Examiner Jagannathan confirmed his direct involvement by leading the Interview discussions. The Examiner's participation afforded Applicant an opportunity to assess his qualifications to examine and evaluate the experimental evidence of record. Applicant was astonished to hear Examiner Jagannathan basically admit he was unqualified to do so based on several of his comments. One of those comments, as discussed previously, included his characterization of Applicant's highly reliable spectroscopic data confirming lower energy states of hydrogen as a "bunch of squiggly lines."

When pressed for guidance on what standards he used to evaluate Applicant's scientific data and to decide whether to issue his patents, Examiner Jagannathan would not elaborate. Rather, he proposed a new standard requiring Applicant to submit and publish his data in peer-reviewed journal articles before he would give it serious consideration. Despite strenuous objections to this newly minted standard, Applicant nonetheless worked diligently to comply with it.

Over the subsequent years, Applicant has used vast resources to present experimental evidence of lower energy states of hydrogen—much of it generated by independent third parties—in over 50 peer-reviewed articles published in the prestigious scientific journals mentioned above. Despite this significant accomplishment, the Committee, true to form, has essentially ignored that published evidence.

It should be further noted that Applicant has successfully met the Committee's new "publication" standard despite attempts by Applicant's main detractor, Dr. Zimmerman, to undermine that effort. [See Attachment H] Applicant's discovery that Dr. Zimmerman has been contacting various journals to dissuade publication of Applicant's articles is especially alarming given that the Committee has relied on non-peer reviewed statements by him—statements that were posted to an internet bulletin board of all places and that he readily admits are biased—to reject claims in BlackLight applications.

If, as Applicant suspects, the Committee has cooperated with Dr. Zimmerman, or other such biased individuals, in denying Applicant his patent rights, while those same individuals have worked behind the scenes to undermine Applicant's compliance with the Committee's concocted publication requirement, then again, that information is highly relevant and should be disclosed without further delay.

Applicant is hardly surprised by his inability to break the PTO's code of silence on the suspicious handling of BlackLight's applications given that the PTO has stonewalled similar inquiries from five U.S. Senators—four of whom requested that Senator Patrick Leahy, Chairman of the Judiciary Committee overseeing the PTO, and/or Commerce Secretary Donald Evans, look into this matter. [See letters to and from Senators Max Cleland, Robert Torricelli, Jon Corzine, Ron Wyden, and Gordon Smith (Attachment O)] The PTO's continued refusal to respond to the Senators' inquiries suggests that, perhaps, it has something to hide.¹⁰¹

If the PTO looks to the Federal Circuit's June 28, 2002 Decision for license to continue its unfair and dilatory prosecution through secret examination, it will not find it. Indeed, Judge Newman, in rationalizing her ruling, incorrectly assumed that the PTO would fairly and expeditiously prosecute BlackLight's applications:

¹⁰¹ In the PTO's reply to the Senators' inquiry letters, Robert L. Stoll, Administrator for External Affairs, contended that any comments in response to those inquiries would be "inappropriate" because of the then-pending appeal to the Federal Circuit in *BlackLight Power Inc. v. Dickinson*, Civ. No. 00-0422 (D.D.C.). [See Attachment O] Putting aside the fact that the issues then on appeal had absolutely nothing to do with the points of inquiry, this contrived excuse has gone stale as the Federal Circuit decided that case years ago in June 2002. [See Attachment B] By its own statements, nothing now prevents the PTO from cooperating with the U.S. Senate regarding the administrative irregularities brought to its attention.

Such action must of course be reasonable under the circumstances and rare in occurrence, lest the emergency become the rule. But when necessary in order to fulfill the PTO's mission, with safeguards to the interests of the applicant including fair and expeditious further examination, we agree with the district court that the action taken is a permissible implementation of the statute and regulation. [See *BlackLight Power* at pages 1537 (Attachment B) (emphasis added).]

Nothing could be further from the truth. As documented by Applicant, the PTO's prosecution of BlackLight's applications has been nothing short of hostile and its attempt to hide the mistreatment of Applicant behind the authority of a Secret Committee only exacerbates the unfairness of those actions. This untenable situation has failed to provide the safeguards to the interests of Applicant, including fair and expeditious further examination, that were contemplated by the Federal Circuit in its Decision and, therefore, has prompted Applicant to herein request an equitable remedy that the PTO immediately issue all five withdrawn BlackLight applications that gave rise to that Decision. [See Demand for Information and Redress, *infra*.]

Applicant strongly urges the PTO to break its silence and to engage in an open and honest discussion of these issues that continue to plague the examination of BlackLight's pending applications. To this end, Applicant renews his earlier commitment, as expressed in Dr. Brewer's December 21, 2001 letter, to meet with the PTO Director and/or any other government officials, anywhere, anytime, to resolve these outstanding issues. Applicant sincerely hopes that the Director will likewise commit himself to achieving the same objective so that a fair and expeditious prosecution of BlackLight's applications that safeguards Applicant's interests, as envisioned by the Federal Circuit, can finally move forward with mutually beneficial results.

Part of that forward movement should include proper consideration of the overwhelming experimental evidence confirming the utility and enablement of Applicant's claimed invention. In view of that evidence, Applicant submits that the rejections under 35 U.S.C. §§ 101 and 112 are misplaced and should be withdrawn, and that the present application is in condition for allowance.

**Discussions Held And Agreements Reached
During The February 11, 2003 Interview**

The above-mentioned problems associated with the Secret Committee's examination of this and other BlackLight applications can be summarized as follows based on its failure to:

- (1) identify all persons from within and outside the Patent Office who contributed to, or were otherwise involved in, withdrawing or rejecting BlackLight's applications;
- (2) identify those persons having ultimate authority to analyze the vast body of experimental evidence demonstrating the existence of lower energy states of hydrogen and, based on that analysis, for deciding whether to issue patents on Applicant's novel hydrogen technology;
- (3) establish and apply consistent patentability standards and guidelines by which that patentability decision is to be made; and
- (4) properly analyze the evidence of record—now published, or to be published, in over 50 peer-reviewed journal articles—that the Committee required Applicant to submit.

The Committee merely perpetuated those failures in its previous Office Actions by dismissing, without serious analysis, Applicant's submitted data evidencing lower energy states of hydrogen. Frustrated by the Committee's inaction, but still determined to get a fair hearing, Applicant requested and received the courtesy of another personal Interview, held February 11, 2003, to present his evidence and to discern the standards by which the ultimate decision-maker would be evaluating it.¹⁰²

To that end, Applicant repeatedly requested that Examiner Jagannathan attend the Interview, since he had led the prior Interview held February 21, 2001, and, despite attempts to keep his identity secret, he was the only person known to have been directly involved in creating the substantive Office Actions of record. Specifically, Applicant sought to question Examiner Jagannathan on why he still refused to accept Applicant's

¹⁰² Although the Interview Summary does not specifically list the serial number of all BlackLight applications as being the subject of the February 11, 2003 Interview, Examiners Langel and Kalafut agreed beforehand that the Interview would be held to address the similar rejection of claims in all assigned BlackLight cases based on an alleged lack of utility and inoperability.

scientific data evidencing lower-energy hydrogen after it had been published, or was soon to be published, in what was then over 40 (now over 50) peer-reviewed journal articles, which he himself had required. Applicant, however, never got the chance to pose that question. Without explanation, Examiner Jagannathan refused to attend the Interview, just as he had refused to attend the Interview held two years earlier—only this time, he did not show up.

Applicant also requested that Examiners Wayne Langel and Stephen Kalafut attend the Interview, since they had previously allowed the five BlackLight applications that were mysteriously withdrawn from issue and their names were the only ones appearing in the record as signers of the substantive Office Actions under consideration. Examiners Langel and Kalafut did appear for the Interview, together with their immediate supervisors, SPE's Patrick Ryan and Stanley Silverman. Examiner William Wayner, who is assigned to one BlackLight application and expressed an interest in attending the Interview, also appeared.

Also attending the Interview and leading the discussions on the PTO's behalf was Quality Assurance Specialist Douglas McGinty, who until that time had never been identified to Applicant as having played any role in the examination of his applications.

Attending the Interview on behalf of BlackLight Power were the inventor, Dr. Randell L. Mills, his counsel, Jeffrey S. Melcher and Jeffrey A. Simenauer, and company Director Dr. Shelby Brewer.

Also attending the Interview as an observer at Applicant's request was Ted C. Liu, Senior Legislative Assistant for Congressman David Wu, who represents the 1st District of Oregon.

During the Interview, Applicant made a sincere effort to advance the prosecution of his applications and to find common ground upon which all of these cases, once again, would be allowed to issue as patents. Applicant believed it was a worthwhile effort in light of Examiner Langel's statements on the record reaffirming his consistent view that Applicant's novel hydrogen technology is fully operable and, therefore, entitled to patent protection. The Interview was also significant in view of the following representations and agreements that resulted from the discussions between Applicant and lead-Specialist McGinty:

- (1) Applicant will identify the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties;
- (2) the Examiners whose signatures appear on the rejections of record, *i.e.*, Examiners Langel, Kalafut, and Wayner, have full authority to review that data and, based on their review, to issue patents as deemed appropriate; and
- (3) Applicant will confer with the signatory Examiners, either by telephone or in person, to review each assigned application on a claim-by-claim basis to ensure that the scientific data presented adequately supports the scope of the claims. For those claims determined to be adequately supported by the data, a patent will issue. For any claims deemed to be inadequately supported, Applicant reserves the right to continue seeking that broader claim coverage in subsequent proceedings.

Applicant appreciated the guidance Specialist McGinty provided during the Interview for securing BlackLight's patents. Based on that guidance, Applicant presented comments in several copending applications for which Responses were due detailing the substance of discussions held at the Patent Office on February 11th and identifying the independent, third-party data per agreement (1) above, which information is reproduced below. [U.S. Serial Nos. 09/110,678 and 09/362,693]

Applicant's comments confirmed Examiner Langel's long-held view that the claims in those cases were in condition for allowance. Applicant therefore requested that Examiner Langel exercise his authority to issue a Notice to that effect per agreement (2) above so that a patent could then be issued.

Following up on the Responses filed in those copending applications per agreement (3) above, Applicant arranged for an Interview with Examiner Langel to review the cases on a claim-by-claim basis to ensure that the scientific data presented adequately supported the scope of the claims in those cases. In fact, Applicant and Examiner Langel reached a tentative understanding that certain claims were adequately supported by the data and that Applicant was therefore entitled to his patents.

Unfortunately for Applicant, that understanding was short lived after Examiner Langel agreed, under the most grievous of circumstances, to his removal from

examining all BlackLight applications to which he was assigned. Before discussing the prejudicial ramifications of that unfortunate incident, however, Applicant presents the following recap of the discussions held during the February 11, 2003 Interview that lead to the above agreements.¹⁰³

Just prior to the Interview, Specialist McGinty asked that Mr. Liu speak by telephone with Talis Dzenitis, a Congressional Affairs Specialist in the PTO's Legislative and International Affairs Office, to discuss his reasons for attending. Mr. Liu explained to Specialist Dzenitis that a constituent associated with BlackLight had contacted Congressman David Wu complaining of the irregular procedures the PTO has used in examining the company's pending patent applications. The procedures complained of included the PTO's withdrawal of the five applications approved by Examiners Langel and Kalafut for issuance as patents and the subsequent rejection of those and other BlackLight applications by an unknown group of PTO officials referred to by Applicant as a "Secret Committee."

Specialist Dzenitis represented to Mr. Liu that no such secret committee exists at the Patent Office. Applicant was surprised by that representation considering that a group of anonymous PTO officials are known to be handling BlackLight's applications and drafting the substantive Office Actions that the Examiners of record are instructed to sign.

Examiner Langel confirmed as much in an extended discussion he had with Mr. Liu and Applicant's counsel following the formal phase of the Interview. During that discussion, Examiner Langel repeated his prior denials of having authored the substantive Office Actions of record in the BlackLight applications to which he was assigned, even though those Actions bear his signature. Examiner Langel also repeated his previously expressed view that Applicant is entitled to patents on his novel hydrogen technology and that he wanted to issue those patents. Examiner Langel explained, however, that other PTO officials unknown to him having higher authority were responsible for drafting the substantive Office Actions he signed and for deciding whether to issue Applicant his patents.

¹⁰³ Much of the substance of these discussions was confirmed in e-mail correspondence between Mr. Liu and Applicant's Counsel. [See Attachment P]

The only person Examiner Langel could identify for Mr. Liu as "having something to do with the Office Actions" was Examiner Jagannathan, whose name does not appear on any Office Action. As noted above, Examiner Jagannathan kept his identity a secret from Applicant until counsel exposed his direct involvement in creating the Office Actions of record and forced him to attend the prior Interview that he led on February 21, 2001. When the recent February 11, 2003 Interview started, it was Specialist McGinty, another previously unidentified PTO official, who led the discussion.

Following the telephone conversation with Specialist Dzenitis, in which he denied the existence of a secret committee, Mr. Liu joined the Interview already in progress. Applicant began the Interview with a general discussion of his novel hydrogen technology and a presentation of the experimental evidence confirming its operation and utility. Specifically, Applicant explained to the PTO officials in attendance how independent laboratory studies, including those conducted by a leading Los Alamos researcher and by a NASA funded group, as well as other highly reliable scientific data, demonstrate the existence of lower energy states of hydrogen underlying his technology.

At no time during Applicant's presentation did the PTO officials analyze or otherwise address to any significant degree the merits of that data proving the existence of lower-energy hydrogen. Rather, these officials—with the exception of Examiner Langel—raised non-technical arguments, similar to those raised in the pending Office Actions, why lower-energy hydrogen could not exist and, thus, why they were justified in according the real-world data little or no weight.

The first such argument, raised by Examiner Wayner, was based on unrelated technologies that have been subjected to ridicule in the scientific community, such as perpetual motion, cold fusion, and 100-miles-per-gallon carburetors. Examiner Wayner compared those controversial technologies to BlackLight's novel hydrogen chemistry and then asked Applicant: "How is your invention any different?"

Applicant pointed out significant differences. Unlike the far-fetched inventions mentioned by Examiner Wayner, Applicant explained that his inventions have been actually reduced to practice, as demonstrated by the many working prototype energy cells developed over the past ten years and the novel chemical compounds produced

by the process, which were made available to the PTO in the past and again during the Interview. In fact, Applicant invited the PTO officials to visit his laboratory in Cranbury, New Jersey and witness the operation of his energy cells for themselves, but like prior invitations, this one too was ignored.

Applicant further distinguished his claimed inventions based on the substantial body of experimental evidence that corroborates the existence of lower energy states of hydrogen. Again, none of the PTO officials who raised non-technical arguments questioning the operability of Applicant's novel hydrogen technology made any real attempt to analyze that corroborating evidence. Indeed, Examiner Wayner frankly admitted that his background was in mechanical engineering and, therefore, he was not qualified to conduct such an analysis.

Examiner Wayner also questioned why, if BlackLight's technology was such an important discovery, the company had not yet developed a commercial device for producing energy. Applicant explained that the high cost of developing commercial products was an impediment and that, because BlackLight was not positioned to handle commercial development, it was looking to license patents on its technology to other companies for commercialization purposes.

Concerned that Examiner Wayner might be introducing yet another new patentability standard, requiring the sale of a commercial product, counsel pressed the Examiner on whether that was his intention. Examiner Wayner plainly stated it was not and, in response to a specific question from Mr. Liu, affirmed that Applicant need not prove commercial applicability to secure a patent for his invention.¹⁰⁴

Applicant also became alarmed when Examiner Wayner, in referring generally to BlackLight's "detractors," invoked only the name of APS lobbyist and spokesman Dr. Robert Park as someone who disputes the existence of lower energy states of hydrogen.¹⁰⁵ Applicant's counsel wanted to raise issues relating to Dr. Park's "Deep

¹⁰⁴ Despite these assurances, Applicant is proceeding under the assumption that the PTO is requiring proof of commercial applicability, especially in light of his discovery that the Committee now takes the position that "allowance is not an option" in BlackLight's cases. [See *infra*.]

¹⁰⁵ To Applicant's astonishment, in the Office Actions issued in Examiner Wayner's one assigned case, the Committee has continued to cite Dr. Park's biased statements against Applicant as a basis for rejecting claims in this case:

Throat" contact in the Patent Office and his reputation for conducting "hatchet jobs" on new technologies that threaten his lobbying of hundreds of millions of dollars on behalf of the APS to federally fund its pet projects. Specialist McGinty, however, cut counsel off, refusing to discuss the matter. When Specialist McGinty suggested that BlackLight has a "similar agenda," noting its recent NASA contract, Applicant corrected him, explaining that BlackLight does not receive any government funding for its research. Specialist McGinty had no response and the discussion moved onto other, less controversial subjects.

Examiner Wayner raised other issues regarding the reliability of the scientific evidence presented by Applicant. That evidence included spectroscopic data, which counsel described as being equivalent to a "chemical fingerprint." Counsel further noted that Dr. Park himself, whom Examiner Wayner identified as BlackLight's chief antagonist, has proclaimed the extraordinary reliability of spectroscopic data. [See *supra*.]

Yet when Applicant tried to present this highly reliable spectroscopic data at the Interview showing the spectral lines corresponding to lower-energy hydrogen, *i.e.*, a "hydrino" state, Examiner Wayner interrupted, stating that "spectroscopic lines are meaningless" and "don't mean a hill of beans" to him.

Counsel again became concerned that BlackLight's applications were being evaluated using rather loose patentability standards. Counsel therefore requested that the PTO officials provide some guidance regarding the evidentiary requirements they were imposing on Applicant. Specialist McGinty and Examiner Wayner at first did not respond directly to Counsel's request for guidance, but rather began questioning the accuracy of the test data Applicant submitted to confirm the existence of lower energy hydrogen.

The opinion of Robert Park set forth in the Examiner's action of 4/14/00, paper #16. *i.e.* "But according to the country's leading organization of academic physicists, Mills' hydrino theory has no credibility. "There is virtually nothing that science does not know about the hydrogen atom," said Robert Park, director of the Washington [sic] office of the American Physical Society. "The ground state is defined as the (energy) state below which you cannot go ... the thought there is some state below the ground state is kind of humorous [sic]." [See 4/26/04 Office Action at p. 4 in U.S. App'n Ser. No. 09/181,180.]

Applicant explained that the submitted test data was generated by highly qualified Ph.D. scientists, many of whom represent independent laboratories. Applicant further noted how this data had been extensively peer-reviewed in the 40-plus (now over 50) articles published, or soon to be published, in prestigious scientific journals, including the *Journal of Applied Physics*. Applicant also provided Specialist McGinty—much to his surprise—with specific data showing the lower-energy state spectral lines that were published in the prestigious spectroscopic publication, *Journal of Molecular Structure*.

Applicant was astounded by the refusal of Specialist McGinty and Examiner Wayner to accept the reliability of the scientific data appearing in these published journal articles, especially considering the PTO's routine acceptance of evidence submitted in printed publications to overcome utility rejections. See, e.g., MPEP § 2107.01 (VI) pp. 2100-33 ("An applicant can [submit evidence in response to a utility rejection] using any combination of the following: amendments to the claims, arguments or reasoning, or new evidence submitted in an affidavit or declaration under 37 CFR 1.132, or in **a printed publication**." (emphasis added)).

Counsel also reminded the PTO officials of the standard imposed by lead-Examiner Jagannathan during the previous Interview held February 21, 2001 that conditioned his consideration of evidence of lower-energy hydrogen on its publication in peer-reviewed journal articles based on the reliability of the peer-review process. Counsel then noted once again that, despite Examiner Jagannathan's failure to provide legal authority for imposing this unreasonable standard, Applicant had not only met it, but had exceeded it with over 40 (now over 50) journal articles. Having done so, counsel expressed extreme frustration with the PTO's continued refusal to seriously analyze the published scientific data based on manufactured excuses, such as this newly concocted one concerning the accuracy of Applicant's data.

Specialist McGinty raised yet another weak excuse for ignoring the published data by asking what assurances Applicant could provide that the journal articles had been actually peer reviewed! Mystified by that question, Applicant could only state what is a simple known fact: to get scientific data published in a journal article, it must first go through a rigorous peer-review process. Indeed, many of Applicant's articles went

through numerous drafts and required further experimentation as directed by the Ph.D. scientists who peer reviewed those articles.

At that point in the Interview, Specialist McGinty admitted that, like Examiner Wayner, he was not qualified to analyze the published data. Applicant was surprised by that admission, since the Interview was being led by Specialist McGinty and had been arranged for the express purpose of presenting the experimental evidence of record.

Examiner McGinty's admission merely fueled Applicant's prior concerns that his published scientific data was not being properly considered, prompting counsel to ask who was responsible for analyzing that data. Specialist McGinty replied by stating that Examiners Langel and Kalafut, the Examiners of record, had that responsibility. That too came as a surprise, since Examiners Langel and Kalafut, of course, were the ones who had originally reviewed Applicant's experimental evidence in allowing the five BlackLight applications that were subsequently withdrawn from issue. Applicant, however, was relieved to learn that these two Examiners, who had over 50 years of experience between them and who were obviously qualified to analyze the published data, were being reassigned that task.

Counsel then addressed the vexing problem of constantly changing patentability standards that had been plaguing the examination process. Counsel specifically mentioned, for example, the prior Office Action that claimed Applicant's lower-energy hydrogen technology violated known laws of physics and chemistry without specifically identifying even one such law, and then required Applicant to prove otherwise.

Counsel also cited a recent Office Action dismissing Applicant's scientific data out of hand for failing to prove the invalidity of quantum theory:

The request for reconsideration has been entered and considered but does not overcome the rejection . . . because there is no evidence presented which would prove applicant's contention that the theory of quantum mechanics is invalid."
[October 7, 2002 Advisory Action entered in U.S. Serial No. 09/110,717]

When Specialist McGinty accused Applicant of putting a "spin" on the Examiner's rejection, counsel noted that he had been reading the above quotation directly from the Office Action.

Counsel also mentioned other recent Office Actions filed in BlackLight cases that dismissed Applicant's recent submission of peer-reviewed journal articles, in accordance with the standards imposed by Examiner Jagannathan, as being merely "cumulative" when it clearly was not and even the originally submitted evidence had not been properly analyzed.

Expressing frustration over the PTO's failure to provide any consistent patentability standards to guide Applicant, counsel once again requested that Specialist McGinty provide such guidance. Specialist McGinty again raised concern over the integrity of the experimental evidence, but indicated that he would be more receptive to that evidence if it was validated by independent third parties.¹⁰⁶

Applicant explained to Specialist McGinty that much of the evidence submitted over the previous four years was, in fact, generated by independent third parties. Applicant then began citing examples of the extensive independent third-party evidence disclosed in publications previously cited to the PTO, as well as more recently generated evidence that was subsequently submitted.¹⁰⁷ Specialist McGinty did not respond, whereupon counsel noted that his unfounded concern that the record evidence lacked third-party validation merely demonstrated the PTO's failure to thoroughly analyze that evidence.

Further demonstrating a lack of familiarity with the record evidence, Specialist McGinty criticized Applicant's experimental evidence as a whole by referring numerous

¹⁰⁶ Just as Specialist McGinty sought assurances at the February 11 Interview that persons involved in generating and furnishing the scientific data submitted by Applicant are independent and unbiased, Applicant deserves similar assurances that those involved in rejecting BlackLight's applications are also independent and unbiased. Despite Applicant's repeated requests for such assurances, none have been given. The genuine conflicts of interest uncovered by Applicant involving Examiner Souw and his clear bias against BlackLight merely underscores the importance of this highly relevant information.

¹⁰⁷ See R. L. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", *Int. J. Hydrogen Energy*, Vol. 26, No. 9, (2001), pp. 965-979.

R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", *J Mol. Struct.*, Vol. 643, No. 1-3, (2002), pp. 43-54.

J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", *Journal of Applied Physics*, submitted.

A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002, http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf.

times to only high-power plasma data. Applicant repeatedly pointed out that the plasma data was but a small fraction of the submitted evidence and that it was presented primarily to provide additional support for his plasma-related applications.

Applicant noted that the vast body of other scientific data he submitted relates to a broad range of analytical studies demonstrating the existence of lower energy states of hydrogen. For example, regarding those applications relating to novel chemical compounds, Applicant pointed Specialist McGinty to the extensive spectroscopic data supporting the identification of those compounds. Specialist McGinty, however, apparently did not understand the significance of that data, stating that the NMR data confirming lower-energy hydrogen could have been due to nitrogen. Applicant had to explain that, as a matter of basic scientific knowledge, NMR data only shows protons and that no other element but hydrogen is in the data range. Applicant also explained that the NMR data confirms the presence of an internal energy source.

Knowing that highly qualified Examiners Langel and Kalafut were once again responsible for analyzing the published data was reassuring. There still remained, however, one nagging issue, namely, who had the ultimate authority to issue Applicant his patents. Counsel expressed concern that the pending applications were being examined in secret and that, without knowing who had that authority, Applicant was being unfairly denied an opportunity to present his case to the actual decision-maker.

Specialist McGinty then stated in no uncertain terms that Examiners Langel, Kalafut, and Wayner, the signers of the Office Actions under consideration, had "full authority" to examine the pending applications and to issue the patents.

Upon hearing that statement, counsel immediately turned to Examiner Langel and asked him point blank whether, after having studied the experimental evidence of record, he still believes that BlackLight's patent applications were allowable. The Examiner replied in no uncertain terms, "Yes, they're still allowable."

Counsel then asked Examiner Langel whether he was prepared to immediately allow the claims and issue Applicant his patents in those applications assigned to him, as is customary during an Interview, to which the Examiner replied, "Fine with me."

Specialist McGinty, however, expressed uneasiness over Examiner Langel's agreement to allow claims at the Interview. Specifically, he stated his concern that even

if Applicant's claimed technology were found to be operable, there were still issues of novelty and nonobviousness to be addressed before a patent could be issued.

Counsel was surprised by that statement given the PTO's arguments over the prior three years that Applicant's inventions were inoperable based on an incorrect assumption that lower-energy hydrogen cannot possibly exist. Counsel pointed out the obvious contradiction in arguing that the Examiners may still need to conduct a prior art search for possible disclosure of Applicant's lower-energy hydrogen technology.

Counsel further noted the PTO's own examination guidelines requiring Examiners to evaluate the operability and utility of a claimed invention together with its novelty and nonobviousness following a complete prior art search. See MPEP § 706.¹⁰⁸ Counsel again turned to Examiner Langel to confirm whether that was his understanding. The Examiner replied that it was and indicated that, in fact, the first thing he did was to conduct a thorough prior art search because he thought that might be the easiest way to dispose of the applications assigned to him. Examiner Langel explained, however, that he was unable to reject the applications on prior art grounds, which was why he originally allowed them.

Counsel acknowledged Specialist McGinty's hesitance to issue Applicant patents covering his claims at the Interview and assured him that Applicant wanted to work with him to remove any lingering concerns. Counsel then specifically asked Specialist McGinty to articulate how they might proceed in trying to accomplish that mutually beneficial goal. In response, Specialist McGinty indicated that, in the next Response to the pending Office Actions, Applicant should focus on identifying the scientific data generated by independent third-party testing, as opposed to test data generated solely by Applicant. Counsel agreed to do that.

¹⁰⁸ MPEP § 706 provides in pertinent part:

After the application has been read and the claimed invention understood, a prior art search for the claimed invention is made. With the results of the prior art search, including any references provided by the applicant, the patent application should be reviewed and analyzed in conjunction with the state of the prior art to determine whether the claims define a useful, novel, nonobvious, and enabled invention that has been clearly described in the specification. The goal of examination is to clearly articulate any rejection early in the prosecution process so that the applicant has the opportunity to provide evidence of patentability and otherwise reply completely at the earliest opportunity.

Specialist McGinty further expressed concern over whether that scientific data, even if assumed to be reliable, was commensurate with the scope of the claims of the various applications to adequately support patentability. Counsel stated that Applicant's data did adequately support the claimed subject matter. Counsel, however, recommended reviewing the claims of each application one by one with the assigned Examiners to see if at least some agreement could be reached as to those claims that are adequately supported and for which patents can be issued. As for any remaining claims that the Examiners believe are not adequately supported by the scientific data, Applicant would be free to seek such broader claim coverage through continued prosecution.

Specialist McGinty agreed that this was a reasonable way to proceed and granted a request by counsel, Mr. Simenauer, that this agreement be memorialized in writing in an attachment to the Interview Summary Form. Mr. Simenauer offered to draft this agreement, as is common practice, and Specialist McGinty enthusiastically accepted the offer. Mr. Simenauer then drafted the following Attachment as Specialist McGinty looked on:

ATTACHMENT TO INTERVIEW SUMMARY FORM

Applicant requested that the following points discussed at the Interview held on February 11, 2003 be included as an Attachment to the Interview Summary Form.

Applicant's counsel and the Examiners in attendance at the Interview agreed to meet again at a future date, either in person or by telephone, to continue discussions regarding the patentability of Applicant's pending patent applications. Specifically, the Examiners expressed concern that Applicant's experimental evidence be commensurate with the scope of the claims. To address that concern, Applicant's counsel agreed with the Examiners to go through the patent applications claim-by-claim with the Examiners and demonstrate how the scientific data supports those claims.

For those claims that are supported by the data, the PTO agrees to issue those claims. For those claims that the PTO determines are not supported by the data, Applicant will continue to seek that broader claim coverage in subsequent proceedings. [Attachment F]

After completing the two-page handwritten Attachment, Mr. Simenauer read it out loud in the presence of Specialist McGinty and Examiner Langel so that they could confirm its accuracy and make any necessary changes. When asked by counsel whether they were satisfied with the wording of the Attachment, Specialist McGinty stated that he was, as did Examiner Langel, who then signed each of the two pages. There was absolutely no confusion as to the agreement to issue patents for those claims found to be supported by the scientific data.

Incredibly, in a transparent attempt to rewrite history, some unknown PTO official apparently instructed Examiner Langel to sign a subsequent communication mailed over two weeks later, on February 26, 2003, that included an attached "Supplement to Interview Summary" (Attachment F), which provides in pertinent part:

The following is a supplement to the summary concerning the February 11, 2003 interview re 09/501,622, etc. . . . A two-page Interview Summary was provided by Examiner Langel. A two page "Attachment to Interview Summary Form" also was provided by Mr. Simenauer. While the Attachment may represent the applicant's understanding of the interview, two points must be clarified.

First the second page of the applicant's attachment states in part: "for those claims that are supported by the data, the PTO agrees to issue those claims." The PTO made no such agreement. Instead, the PTO representatives indicated that the rejections under both 35 USC 101 and 112, 1st para., are outstanding and that evidence as to verification by credible, established, independent third parties would carry more persuasive weight.

Second, QAS Douglas McGinty was not listed in the Examiner's Interview Summary. He was present during the interview with the aforementioned attendees.

[signed] Wayne Langel
Primary Examiner
Art unit 1754

If PTO officials wanted to retract one of the key agreements reached at the Interview, they should have expressly said so, identifying who made the decision and giving reasons for the retraction. Since this was not done, Applicant has no choice but to rely on the accuracy of the contemporaneous written record.

Moreover, in view of other agreements reached at the Interview, the suggestion that there was no agreement to issue patents under the stated conditions is absurd—though hardly surprising given the sordid prosecution history of BlackLight's patent applications. Specialist McGinty plainly stated on the record that the Examiners who signed the outstanding rejections have full authority to review the data and to issue Applicant his patents. Also of record is Examiner Langel's unequivocal statement that, based on his review, he was prepared to issue those patents. To then force this same Examiner to sign a statement two weeks after the fact denying that "for those claims that are supported by the data, the PTO agrees to issue those claims" is, frankly, embarrassing.

Other ineffective arguments, such as those made by Examiner Kalafut that "the present Examiner did not commit to any agreements during the interview," are also disappointing and, hopefully, will not be repeated. [See Advisory Action dated April 2, 2003 filed in U.S. App'n. Ser. No. 08/467,911.] Applicant acknowledges that, to the best of his recollection, Examiner Kalafut, although present at the February 11 Interview, did not speak a word. As previously indicated, it was Specialist McGinty who led the Interview on behalf of the PTO and it was he who ultimately agreed to the terms under which examination of BlackLight's patent applications would proceed, which terms were expressly reduced to writing. For Examiner Kalafut, or any other Examiner assigned to one of BlackLight's applications, to now attempt to distance themselves from that agreement based on the weak assertion that they did not personally commit to it during the Interview merely illustrates yet another example of the PTO's arbitrary and capricious approach to examining these applications.

Applicant's Identification of Scientific Data Supporting Lower energy States of Hydrogen Generated and Furnished By Independent Third-Parties

In light of the controversial prosecution history of this and other pending BlackLight cases, Applicant appreciated what seemed to be Specialist McGinty's willingness to set reasonable standards and guidelines by which Applicant's patents could finally be issued. Applicant acknowledged and documented Specialist McGinty's concern over the reliability of the record evidence, which led to his requirement that

Applicant identify independent third-party verification of the scientific data as noted in the Supplemental Interview Summary. With those standards and guidelines in mind, Applicant presented in copending applications a summary of the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties, which is reproduced below along with additional, newly submitted data.¹⁰⁹

Experimental Evidence Generated by Independent Third Parties

Applicant is unaware of any statutes, rules, or case law requiring that experimental evidence submitted by an Applicant in response to a rejection by the PTO be generated by independent third parties. Despite the higher standard imposed by Specialist McGinty requiring such third-party validation of the evidence, Applicant still has met and far exceeded this standard as shown below.

Applicant provides the following alphabetical list of independent third-party laboratories and universities that conducted the experiments and generated the scientific data relied upon and discussed in the 47 analytical studies that follow this list:

Advanced Research - Pirelli Labs, Milan, Italy

Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base

Atomic Energy Canada Limited, Chalk River Laboratories

Brookhaven National Laboratory

Charles Evans & Associates, Sunnyvale, CA

Charles Evans East, East Windsor, NJ

Environmental Catalysis and Materials Laboratory of Virginia Polytechnic Institute

Franklin and Marshall College

Galbraith Laboratories, Inc., Knoxville, TN

Grace Davison, Columbia, MD

¹⁰⁹ See, for example, U.S. Serial Nos. 09/110,678 and 09/362,693.

IC Laboratories, Amawalk, NY

Idaho National Engineering Laboratory

Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany)

Jobin Yvon Inc., Edison, NJ

Laboratory for Electrochemistry of Renewed Electrode-Solution Interface
(LEPGER)

Liebert Corporation, Division of Emerson Corporation

Los Alamos National Laboratory

Material Testing Laboratory, Pennington, NJ

MIT Lincoln Laboratories

Moscow Power Engineering Institute

NASA Lewis

National Research Council of Canada

PacifiCorp

Pennsylvania State University Chemical Engineering Department

Perkin-Elmer Biosystems, Framingham, MA

Pirelli Labs, Milan, Italy

Ricerca, Inc., Painesville, Ohio

Rider University, Lawrenceville NJ

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel

Ruhr University, Bochum, Germany

Shrader Analytical & Consulting Laboratories

Spectral Data Services, Inc., Champaign, IL

S. S. W., University of Western Ontario, Canada

Surface Science Laboratories, Mountain View, CA

Thermacore, Inc., Lancaster, PA

University of Delaware, Wilmington, DE

University of Massachusetts Amherst, Amherst, MA

University of New Mexico

Westinghouse Electric Corporation

Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University,
Bethlehem, PA

The following 47 abstracts briefly describe the analytical studies of the scientific data generated by these independent third parties (highlighted in underline).

Independent Test Results

51. J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. This is the third in a series of papers by our team on apparently anomalous Balmer series line broadening in hydrogen containing RF generated, low pressure (< 600 mTorr) plasmas. In this paper the selective broadening of the atomic hydrogen lines in pure H₂ and Ar/H₂ mixtures in a large "GEC" cell (36 cm length X 14 cm ID) was mapped as a function of position, H₂/Ar ratio, time, power, and pressure. Several observations regarding the selective line broadening were particularly notable as they are unanticipated on the basis of earlier models. First, the anomalous broadening of the Balmer lines was found to exist throughout the plasma, and not just in the region between the electrodes. Second, the broadening was

consistently a complex function of the operating parameters particularly gas composition (highest in pure H₂) position, power and pressure. Clearly not anticipated by earlier models were the findings that under some conditions the highest concentration of "hot" (>10 eV) hydrogen was found at the entry end, and not in the high field region between the electrodes and that in other conditions, the hottest H was at the (exit) pump (also grounded electrode) end. Third, excitation and electron temperatures were less than one eV in all regions of the plasma not directly adjacent (>1mm) to the electrodes, providing additional evidence that the energy for broadening, contrary to standard models, is not obtained from the field. Fourth, in contrast to our earlier studies of hydrogen/helium and water plasmas, we found that in some conditions 98% of the atomic hydrogen was in the "hot" state throughout the GEC cell. Virtually every operating parameter studied impacted the character of the hot H atom population, and clearly second and third order effects exist, indicating a need for experimental design. Some non-field mechanisms for generating hot hydrogen atoms, specifically those suggested by Mills' CQM model, are outlined.

50. J. Phillips, C. K. Chen, R. Mills, "Evidence of the Production of Hot Hydrogen Atoms in RF Plasmas by Catalytic Reactions Between Hydrogen and Oxygen Species", *Spectrochimica Acta Part B: Atomic Spectroscopy*, submitted.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. Selective H-atom line broadening was found to be present throughout the volume (13.5 cm ID x 38 cm length) of RF generated H₂O plasmas in a GEC cell. Notably, at low pressures (ca. <0.08 Torr), a significant fraction (ca. 20%) of the atomic hydrogen was 'hot' with energies greater than 40 eV with a pressure dependence, but only a weak power dependence. The degree of broadening was virtually independent of the position studied within the GEC cell, similar to the recent finding for He/H₂ plasmas in the same GEC cell. In contrast to the atomic hydrogen lines, no broadening was observed in oxygen species lines at low pressures. Also, in 'control' Xe/H₂ plasmas run in the same cell at similar pressures and adsorbed

power, no significant broadening of atomic hydrogen, Xe , or any other lines was observed. Stark broadening or acceleration of charged species due to high electric fields can not explain the results since i) the electron density was insufficient by orders of magnitude, ii) the RF field was essentially confined to the cathode fall region in contrast to the broadening that was independent of position, and iii) only the atomic hydrogen lines were broadened. Rather, all of the data is consistent with a model that claims specific, predicted, species can act catalytically through a resonant energy transfer mechanism to create 'hot' hydrogen atoms in plasmas.

49. R. L. Mills, Y. Lu, B. Dhandapani, "Spectral Identification of $H_2(1/2)$ ", submitted.

Lower-energy molecular hydrogen lines were independently recorded and interpreted by Stephan Fuelling of the University of Nevada, Reno and the Nevada Terawatt Facility and provided to BlackLight. Novel emission lines with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9$, or 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}$; ($p \leq 137$ is an integer) replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. Evidence supports that these states are formed by a resonant nonradiative energy transfer to He^+ acting as a catalyst; whereas, krypton, xenon, and their ions serve as controls. Two $H(1/2)$ may react to form $H_2(1/2)$ with emission of the bond energy from a resonant state within its transition state with vibration-rotational energies that are the same as those of H_2 . A series of vibration-rotational bands in the 60-67 nm region, a high-energy region for which vibration-rotational spectra are ordinarily unknown, was observed from low-pressure helium-hydrogen (99/1%) microwave plasmas that matched the predicted energy spacing of the vibrational energy of H_2 about the bond energy of $H_2(1/2)$ corresponding to the reaction $2H(1/2) \rightarrow H_2(1/2)$.

48. J. Phillips, C. K. Chen, "Evidence of Energetic Reaction Between Helium and Hydrogen Species in RF Generated Plasmas", Philosophy Magazine, submitted.

A study of the line shapes of hydrogen Balmer series lines in RF generated low pressure H₂/He plasmas performed at the University of New Mexico, Department of Chemical and Nuclear Engineering produced results suggesting a catalytic process between helium and hydrogen species results in the generation of 'hot' (ca. 28 eV) atomic hydrogen. Even far from the electrodes (ca. 15 cm) both 'cold' (<2.5 eV) and 'hot' atomic hydrogen were found in H₂/He plasmas. Line shapes, relative line areas of cold and hot atomic hydrogen (hot/cold>2.5), were very similar for areas between the electrodes and far from the electrodes for these plasmas. In contrast, in H₂/Xe only 'warm' (<5 eV) hydrogen (warm/cold<1.0) was found between the electrodes, and only cold hydrogen away from the electrodes. Earlier postulates that preferential hydrogen line broadening in plasmas results from the acceleration of ionic hydrogen in the vicinity of electrodes, and the special charge exchange characteristics of Ar/H₂⁺ are clearly belied by the present results that show atomic hydrogen line shape are similar for H₂/He plasmas throughout the relatively large cylindrical (14 cm ID x 36 cm length) cavity.

47. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, Luca Gamberale, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", J. Phys. B: At. Mol. Opt. Phys., submitted.

Luca Gamberale of the Advanced Research - Pirelli Labs, Milan, Italy performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of a chemically generated hydrogen plasma, extraordinarily broadened atomic hydrogen lines, lower-energy hydrogen molecular-ion lines, the isolation and characterization of lower-energy molecular hydrogen gas, and excess power measured by water bath calorimetry were replicated. Specifically, plasmas of certain catalysts such as Sr⁺, Ar⁺, and He⁺ mixed with hydrogen were studied for evidence of a novel energetic reaction. A hydrogen plasma

was observed to form at low temperatures (e.g. $\approx 10^3$ K) and an extraordinary low field strength of about 1-2 V/cm when argon and strontium were present with atomic hydrogen. RF and microwave plasmas were used to generate He^+ and Ar^+ catalysts. Extraordinarily fast H (40-50 eV) was observed by Balmer α line broadening only from plasmas having a catalyst with H. Novel emission lines with energies of $q \cdot 13.6$ eV where $q = 1, 2, 3, 4, 6, 7, 8, 9$, or 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad (p \leq 137 \text{ is an integer})$$

replaces the well known parameter $n = \text{integer}$ in

the Rydberg equation for hydrogen excited states. $H(1/p)$ may react with a proton and two $H(1/p)$ may react to form $H_2(1/p)^+$ and $H_2(1/p)$, respectively, that have vibrational and rotational energies that are p^2 times those of the species comprising uncatalyzed atomic hydrogen. A series of over twenty peaks in the 10-65 nm region emitted from low-pressure helium-hydrogen (90/10%) and argon-hydrogen (90/10%) microwave plasmas matched the energy spacing of 2^2 times the transition-state vibrational energy of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$. $H_2(1/p)$ gas was isolated by liquefaction using an high-vacuum (10^{-6} Torr) capable, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), visible and EUV optical emission spectroscopy (OES), and 1H NMR of the condensable gas dissolved in $CDCl_3$. Novel peaks were observed by cryogenic gas chromatography performed on the condensable gas which was highly pure hydrogen by MS and had a higher ionization energy than H_2 . The observation that the EUV emission spectrum changed with deuterium substitution in a region where no hydrogen emission has ever been observed further supported the existence of lower-energy molecular hydrogen. Contaminants and exotic helium-hydrogen species were eliminated as the source of the reaction and condensed gas plasma emission spectra. Upfield shifted NMR peaks were observed at 3.47 ppm and 2.18 ppm compared to that of H_2 at 4.63 ppm that matched $H_2(1/2)$ and $H_2(1/4)$, respectively. Excess power was absolutely measured from the

helium-hydrogen plasma. For an input of 44.3 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.9 W corresponding to 18.6 W of excess power in 3 cm^3 . The excess power density and energy balance were high, 6.2 W/cm^3 and $-5 \times 10^4 \text{ kJ/mole } H_2$ (240 eV/H atom), respectively.

46. R. L. Mills, Y. Lu, J. He, M. Nansteel, P. Ray, X. Chen, A. Voigt, B. Dhandapani, "Spectral Identification of New States of Hydrogen", J. Mol. Struct., submitted.

Novel emission lines with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$ were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}$; ($p \leq 137$ is an integer) replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. Evidence supports that these states are formed by a resonant nonradiative energy transfer to He^+ acting as a catalyst. Ar^+ also serves as a catalyst to form $H(1/p)$; whereas, krypton, xenon, and their ions serve as controls. $H(1/p)$ may react with a proton and two $H(1/p)$ may react to form $H_2(1/p)^+$ and $H_2(1/p)$, respectively, that have vibrational and rotational energies that are p^2 times those of the species comprising uncatalyzed atomic hydrogen. A series of over twenty peaks in the 10-65 nm region emitted from low-pressure helium-hydrogen (90/10%) and argon-hydrogen (90/10%) microwave plasmas matched the energy spacing of 2^2 times the transition-state vibrational energy of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$. Rotational lines were observed in the 145-300 nm region from atmospheric pressure electron-beam excited argon-hydrogen plasmas. The unprecedented energy spacing of 4^2 times that of hydrogen established the internuclear distance as 1/4 that of H_2 and identified $H_2(1/4)$. The results were independently recorded at Rutgers University. $H_2(1/p)$ gas was isolated by liquefaction at liquid nitrogen temperature and by decomposition of compounds found to contain the corresponding hydride ions $H^-(1/p)$.

The $H_2(1/p)$ gas was dissolved in $CDCl_3$ and characterized by 1H NMR at Rider University, Lawrenceville NJ. Considering solvent effects, singlet peaks upfield of H_2 were observed with a predicted integer spacing of 0.64 ppm at 3.47, 3.02, 2.18, 1.25, 0.85, and 0.22 ppm which matched the consecutive series $H_2(1/2)$, $H_2(1/3)$, $H_2(1/4)$, $H_2(1/5)$, $H_2(1/6)$, and $H_2(1/7)$, respectively. Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 41.9 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.1 W corresponding to 20.2 W of excess power in 3 cm^3 plasma volume. The excess power density and energy balance were high, 6.7 W/cm^3 and $-5.4 \times 10^4\text{ kJ/mole } H_2$ (280 eV/H atom), respectively. In addition to power applications, battery and propellant reactions are proposed that may be transformational, and observed excited vibration-rotational levels of $H_2(1/4)$ could be the basis of a UV laser that could significantly advance photolithography.

45. Dr. K.D. Keefer, Report on BlackLight Power Technology: Its Apparent Scientific Basis, State of Development and Stability for Commercialization by Liebert Corporation, (2001), and, Report on BlackLight Power Technology: Its Apparent Scientific Basis, State of Development and Stability for Commercialization, (2002).

To separate reports disclosing the results of NMR, ToF-SIMS, XPS identification of novel hydrino hydride compounds and analysis of chemically-produced plasma by an expert hired by the Liebert Corporation, a division of the well-known and highly-respected Emerson Corporation. According to the expert's own words, he "observed demonstrations of the BlackLight Power (BLP) process and ...reached the inescapable conclusion that it is based on extraordinary chemical reactions that seem to release extraordinary amounts of energy.... It is [his] professional opinion that the BLP process represents a chemical conversion of atomic hydrogen unlike any previously reported [in] the archival scientific literature." Although the expert states that he was skeptical of Applicant's theory, he admitted that the chemical and plasma data did support

Applicant's fractional quantum states and that he could offer no other explanation of the data using conventional quantum theory.

44. A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002,

http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf.

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,

ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

43. J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", Journal of Applied Physics, Vol. 96, No. 6, pp. 3095-3102.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. Water bath calorimetry was used to demonstrate one more peculiar phenomenon associated with a certain class of mixed gas plasmas termed resonant transfer, or rt-plasmas. Specifically, $He/H_2(10\%)$ (500 mTorr), $Ar/H_2(10\%)$ (500 mTorr), and $H_2O(g)$ (500 mTorr and 200 mTorr) plasmas generated with an Evenson microwave cavity consistently yielded on the order of 50% more heat than non rt-plasma (controls) such as He , Kr , $Kr/H_2(10\%)$, under identical conditions of gas flow, pressure, and microwave operating conditions. The excess power density of rt-plasmas was of the order $10 \text{ W} \cdot \text{cm}^{-3}$. In earlier studies with these same rt-plasmas it was demonstrated that other unusual features were present including dramatic broadening of the hydrogen Balmer series lines, unique vacuum ultraviolet (VUV) lines, and in the case of water plasmas, population inversion of the hydrogen excited states. Both the current results and the earlier results are completely consistent with the existence of a hitherto unknown exothermic chemical reaction, such as that predicted by Mills, occurring in rt-plasmas.

42. R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Line Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas", J. Plasma Phys., submitted.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. It was demonstrated that low pressure (~ 0.2 Torr) water vapor plasmas generated in a 10 mm ID quartz tube with an Evenson microwave cavity show at least two features which are not explained by conventional plasma models. First, significant ($> 2.5 \text{ \AA}$) hydrogen Balmer α line broadening was recorded, of constant width, up to 5 cm from the microwave coupler. Only hydrogen, and not oxygen, showed significant line broadening. This feature, observed previously in hydrogen-containing mixed gas plasmas generated with high voltage DC and RF discharges was explained by some researchers to result from acceleration of hydrogen ions near the cathode. This explanation cannot apply to the line broadening observed in the (electrodeless) microwave plasmas generated in this work, particularly at distances as great as 5 cm from the microwave coupler. Second, dramatic inversion of the line intensities of both the Lyman and Balmer series, again, at distances up to 5 cm from the coupler were observed. The dramatic line inversion suggests the existence of a hitherto unknown source of pumping of the optical power in plasmas. Finally, it is notable that other aspects of the plasma including the OH^* rotational temperature and low electron concentrations are quite typical of plasmas of this type.

41. H. Conrads, R. Mills, Th. Wrubel, "Emission in the Deep Vacuum Ultraviolet from a Plasma Formed by Incandescently Heating Hydrogen Gas with Trace Amounts of Potassium Carbonate", Plasma Sources Science and Technology, Vol. 12, (2003), pp. 389-395.

The generation of a hydrogen plasma with intense extreme ultraviolet and visible emission was observed at Ruhr University, Bochum, Germany from low pressure hydrogen gas (0.1-1 mbar) in contact with a hot tungsten filament only when the filament heated a titanium dissociator coated with K_2CO_3 above 750°C . The dissociator was electrically floated, and the electric field strength from the filament was about 1 V/cm, two orders of magnitude lower than the starting voltages measured for gas glow discharges. The emission of the H_α and H_β transitions as well as the L_α and L_β

transitions were recorded and analyzed. The plasma seemed to be far from thermal equilibrium, and no conventional mechanism was found to explain the formation of a hydrogen plasma by incandescently heating hydrogen gas with the presence of trace amounts of K_2CO_3 . The temporal behavior of the plasma was recorded via hydrogen Balmer alpha line emission when all power into the cell was terminated. A two second decay of the plasma was observed after a fast decay of the electric field to zero. The plasma was found to be dependent on the chemistry of atomic hydrogen with potassium since no plasma formed with Na_2CO_3 replacing K_2CO_3 and the time constant of the emission following the removal of all of the power to the cell matched that of the cooling of the filament and the resulting shift from atomic to molecular hydrogen. Our results indicate that a novel chemical power source is present that forms the energetic hydrogen plasma. The plasma is a potential new light source.

40. R. Mills, "Observation of Extreme Ultraviolet Emission from Hydrogen-KI Plasmas Produced by a Hollow Cathode Discharge", Int. J. Hydrogen Energy, Vol. 26, No. 6, (2001), pp. 579-592.

A high voltage discharge of hydrogen with and without the presence of a source of potassium, potassium iodide, in the discharge was performed at Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany) with a hollow cathode. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g. $< 10^3$ K) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV [1, 3-5]. Two potassium ions or a potassium atom may each provide an electron ionization or transfer reaction that has a net enthalpy equal to an integer multiple of 27.2 eV. The spectral lines of atomic hydrogen were intense enough to be recorded on photographic films only when KI was present. EUV lines not assignable to potassium, iodine, or hydrogen were observed at 73.0, 132.6, 513.6, 677.8, 885.9, and 1032.9 Å. The lines are assigned to transitions of atomic hydrogen to lower energy levels corresponding to lower energy hydrogen atoms called hydrino atoms and the

emission from the excitation of the corresponding hydride ions formed from the hydrino atoms.

- 39. R. Mills, "Temporal Behavior of Light-Emission in the Visible Spectral Range from a $\text{Ti-K}_2\text{CO}_3\text{-H-Cell}$ ", Int. J. Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 327-332.**

Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany)

reports the generation of a hydrogen plasma and extreme ultraviolet emission as recorded via the hydrogen Balmer emission in the visible range. Typically a hydrogen plasma is generated and the emission of extreme ultraviolet light from hydrogen gas is achieved via a discharge at high voltage, a high power inductively coupled plasma, or a plasma created and heated to extreme temperatures by RF coupling (e.g. $> 10^6 \text{ K}$) with confinement provided by a toroidal magnetic field. The observed plasma formed at low temperatures (e.g. $\approx 10^3 \text{ K}$) from atomic hydrogen generated at a tungsten filament that heated a titanium dissociator coated with potassium carbonate. The temporal behavior of the plasma was recorded via hydrogen Balmer alpha line emission when all power into the cell was terminated. A two second decay of the plasma was observed after a fast decay of the electric field to zero. The persistence of emission following the removal of all of the power to the cell indicates that a novel chemical power source is present that forms an energetic plasma in hydrogen. No unusual behavior was observed with the control sodium carbonate.

- 38. R. Mills, J. Sankar, A. Voigt, J. He, P. Ray, B. Dhandapani, "Synthesis and Characterization of Diamond Films from MPCVD of an Energetic Argon-Hydrogen Plasma and Methane", Materials Science, submitted.**

Polycrystalline diamond films were synthesized on silicon substrates by a low power (~80 W) microwave plasma chemical vapor deposition (MPCVD) reaction of a mixture of argon-hydrogen-methane (17.5/80/2.5%). The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory,

Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that Ar^+ served as a catalyst with atomic hydrogen to form an energetic plasma. CH , C_2 , and C_3 emissions were observed with significantly broadened H α line. The average hydrogen atom temperature of a argon-hydrogen-methane plasma was measured to be 110-130 eV versus ≈ 3 eV for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

37. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", J. Phys. Chem. A, submitted.

$2K^+$ to $K + K^{2+}$ and K to K^{3+} provide a reaction with a net enthalpy equal to the one and three times the potential energy of atomic hydrogen, respectively. The presence of these gaseous ions or atoms with thermally dissociated hydrogen formed a so-called resonance transfer (rt) plasma having strong VUV emission with a stationary inverted Lyman population. Significant line broadening of the Balmer α , β , and γ lines of 18 eV was observed, compared to 3 eV from a hydrogen microwave plasma. Emission from rt-plasmas occurred even when the electric field applied to the plasma was zero as recorded at Institut für Niedertemperatur-Plasmaphysik e.V. (INP Greifswald, Germany. The reaction was exothermic since excess power of 20 $mW \cdot cm^{-3}$ was measured by Calvet calorimetry. An energetic catalytic reaction was proposed involving a resonant energy transfer between hydrogen atoms and $2K^+$ or K to form very stable novel hydride ions $H^-(1/p)$ called hydrino hydrides having a fractional principal quantum numbers $p = 2$ and $p = 4$, respectively. Characteristic

emission was observed from K^{2+} and K^{3+} that confirmed the resonant nonradiative energy transfer of 27.2 eV and $3 \cdot 27.2\text{ eV}$ from atomic hydrogen to $2K^+$ and K , respectively.

The predicted binding energy of $H^-(1/2)$ of 3.0471 eV with the fine structure was observed at 4071 Å , and its predicted bound-free hyperfine structure lines $E_{HF} = j^2 3.00213 \times 10^{-5} + 3.0563\text{ eV}$ (j is an integer) matched those observed for $j = 1$ to $j = 37$ to within a 1 part per 10^4 . $H^-(1/4)$ was observed spectroscopically at 110 nm corresponding to its predicted binding energy of 11.2 eV . The ^1H MAS NMR spectrum (Spectral Data Services, Inc., Champaign, IL) of novel compound KH^*Cl relative to external tetramethylsilane (TMS) showed a large distinct upfield resonance at -4.4 corresponding to an absolute resonance shift of -35.9 ppm that matched the theoretical prediction of $p = 4$. A novel NMR (Grace Davison, Columbia, MD and Spectral Data Services, Inc., Champaign, IL) peak of KH^*I at -1.5 ppm relative to TMS corresponding to an absolute resonance shift of -33.0 ppm matched the theoretical prediction of $p = 2$. The predicted catalyst reactions, position of the upfield-shifted NMR peaks, and spectroscopic data for $H^-(1/2)$ and $H^-(1/4)$ were found to be in agreement.

36. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas", *Acta Physica Polonica A*, submitted.

Extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of $q \cdot 13.6\text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9, 11$ or these discrete energies less 21.2 eV corresponding to inelastic scattering of these photons by helium atoms due to excitation of $He(1s^2)$ to $He(1s^1 2p^1)$. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen, formed by a resonant nonradiative energy transfer to He^+ . Corresponding emission due to the reaction $2H(1/2) \rightarrow H_2(1/2)$ with vibronic coupling at

$$E_{D+vib} = p^2 E_{D\ H_2} \pm \left(\frac{\nu^*}{3} \right) E_{vib\ H_2(\nu=0 \rightarrow \nu=1)}, \quad \nu^* = 1, 2, 3, \dots \text{ was observed at the longer}$$

wavelengths for $\nu^* = 2$ to $\nu^* = 32$ and at the shorter wavelengths for $\nu^* = 1$ to $\nu^* = 16$

where $E_{D\ H_2}$ and $E_{vib\ H_2(\nu=0\rightarrow\nu=1)}$ are the experimental bond and vibrational energies of H_2 , respectively. Fractional-principal-quantum-level molecular hydrogen $H_2(1/p)$ gas was isolated by liquefaction using an ultrahigh-vacuum, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), optical emission spectroscopy (OES), and 1H NMR (Rider University, Lawrenceville NJ) of the condensable gas dissolved in $CDCl_3$. The condensable gas was highly pure hydrogen by GC and MS and had a higher ionization energy than H_2 . An upfield shifted NMR peaks were observed at 3.47 and 2.18 ppm compared to that of H_2 at 4.63 ppm. A theoretical rocketry propellant reaction is given that may be transformational.

35. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Spectroscopic Characterization of the Atomic Hydrogen Energies and Densities and Carbon Species During Helium-Hydrogen-Methane Plasma CVD Synthesis of Single Crystal Diamond Films", *Chemistry of Materials*, Vol. 15, (2003), pp. 1313-1321.

Polycrystalline diamond films were synthesized on silicon substrates for the first time without diamond seeding by a very low power (38 W) microwave plasma continuous vapor deposition (MPCVD) reaction of a mixture of helium-hydrogen-methane (48.2/48.2/3.6%). The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA and Jobin Yvon Inc., Edison, NJ), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada and Material Testing Laboratory, Pennington, NJ), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that He^+ served as a catalyst with atomic hydrogen to form an energetic plasma. CH , C_2 , and C_3 emissions were observed with significantly broadened $H\ \alpha$, β , γ , and δ lines. The average hydrogen atom temperature of a helium-hydrogen-methane plasma was measured to be 120 - 140 eV versus ≈ 3 eV for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is

eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

34. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Low Power MPCVD of Diamond Films on Silicon Substrates", Journal of Vacuum Science & Technology A, submitted.

Polycrystalline diamond films were synthesized on silicon substrates for the first time without diamond seeding by a very low power (38 W) microwave plasma continuous vapor deposition (MPCVD) reaction of a mixture of 10-30% hydrogen, 90-70% helium, and 1-10% CH_4 . The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA), scanning electron microscopy (SEM) (S. S. W., University of Western Ontario, Canada and Material Testing Laboratory, Pennington, NJ), and X-ray diffraction (XRD) (IC Laboratories, Amawalk, NY). It is proposed that He^+ served as a catalyst with atomic hydrogen to form an energetic plasma. The average hydrogen atom temperature was measured to be 180-210 eV versus ≈ 3 eV for pure hydrogen. The electron temperature T_e for helium-hydrogen was 28,000 K compared to 6800 K for pure helium. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of diamond. Then, by this novel pathway, the relevance of the CO tie line is eliminated along with other stringent conditions and complicated and inefficient techniques which limit broad application of the versatility and superiority of diamond thin film technology.

33. R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Spectroscopic Identification of Lithium Chloro Hydride", Materials Characterization, submitted.

A novel inorganic hydride compound, lithium chloro hydride ($LiHCl$), which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and lithium chloride. Lithium chloro hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), 1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and powder X-ray diffraction (IC Laboratories, Amawalk, NY). Hydride ions with increased binding energies may form many novel compounds with broad applications such as the oxidant of a high voltage battery.

32. R. L. Mills, B. Dhandapani, J. He, "Highly Stable Amorphous Silicon Hydride", Solar Energy Materials & Solar Cells, Vol. 80, No. 1, (2003), pp. 1-20.

A novel highly stable hydrogen terminated silicon coating was synthesized by microwave plasma reaction of mixture of silane, hydrogen, and helium wherein it is proposed that He^+ served as a catalyst with atomic hydrogen to form highly stable silicon hydrides. Novel silicon hydride was identified by time of flight secondary ion mass spectroscopy and X-ray photoelectron spectroscopy. The time of flight secondary ion mass spectroscopy (ToF-SIMS) identified the coatings as hydride by the large SiH^+ peak in the positive spectrum and the dominant H^- in the negative spectrum. Since hydrogen is the only element with no primary element peaks, X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) identified the H content of the SiH coatings as comprising novel silicon hydrides due to new peaks at 11, 43, and 55 eV in the absence of corresponding peaks of any candidate element at higher binding energies. The silicon hydride surface was remarkably stable to air as shown by XPS. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and possibly altering the dielectric constant and band gap to increase device performance.

31. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Synthesis of HDLC Films from Solid Carbon", Thin Solid Films, submitted.

Diamond-like carbon (DLC) films were synthesized on silicon substrates from solid carbon by a very low power (~ 60 W) microwave plasma chemical vapor deposition (MPCVD) reaction of a mixture of 90-70% helium and 10-30% hydrogen. It is proposed that He^+ served as a catalyst with atomic hydrogen to form an energetic plasma. The average hydrogen atom temperature of a helium-hydrogen plasma was measured to be 180-210 eV versus ≈ 3 eV for pure hydrogen. Bombardment of the carbon surface by highly energetic hydrogen formed by the catalysis reaction may play a role in the formation of DLC. The films were characterized by time of flight secondary ion mass spectroscopy (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and Raman spectroscopy (Charles Evans & Associates, Sunnyvale, CA). TOF-SIMS identified the coatings as hydride by the large H^+ peak in the positive spectrum and the dominant H^- in the negative spectrum. The XPS identification of the H content of the CH coatings as a novel hydride corresponding to a peak at 49 eV has implications that the mechanism of the DLC formation may also involve one or both of selective etching of graphitic carbon and the stabilization of sp^3 -bonded carbon by the hydrogen catalysis product. Thus, a novel H intermediate formed by the plasma catalysis reaction may enhance the stabilization and etching role of H used in past methods.

30. R. L. Mills, J. He, P. Ray, B. Dhandapani, X. Chen, "Synthesis and Characterization of a Highly Stable Amorphous Silicon Hydride as the Product of a Catalytic Helium-Hydrogen Plasma Reaction", Int. J. Hydrogen Energy, in press.

A novel highly stable surface coating $SiH(1/p)$ which comprised high binding energy hydride ions was synthesized by a microwave plasma reaction of a mixture of silane, hydrogen, and helium wherein it is proposed that He^+ served as a catalyst with atomic hydrogen to form the highly stable hydride ions. Novel silicon hydride was identified by time of flight secondary ion mass spectroscopy and X-ray photoelectron spectroscopy. The time of flight secondary ion mass spectroscopy (ToF-SIMS) identified the coatings as hydride by the large SiH^+ peak in the positive spectrum and

the dominant H^- in the negative spectrum. X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) identified the H content of the SiH coatings as hydride ions, $H^-(1/4)$, $H^-(1/9)$, and $H^-(1/11)$ corresponding to peaks at 11, 43, and 55 eV, respectively. The silicon hydride surface was remarkably stable to air as shown by XPS. The highly stable amorphous silicon hydride coating may advance the production of integrated circuits and microdevices by resisting the oxygen passivation of the surface and possibly altering the dielectric constant and band gap to increase device performance.

The plasma which formed $SiH(1/p)$ showed a number of extraordinary features. Novel emission lines with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9$, or 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, Vol. 27, No. 3, pp. 301-322]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen where p is an integer, formed by a resonant nonradiative energy transfer to He^+ acting as a catalyst. The average hydrogen atom temperature of the helium-hydrogen plasma was measured to be 180-210 eV versus $\approx 3 \text{ eV}$ for pure hydrogen. Using water bath calorimetry, excess power was observed from the helium-hydrogen plasma compared to control krypton plasma. For example, for an input of 8.1 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 30.0 W corresponding to 21.9 W of excess power in 3 cm^3 . The excess power density and energy balance were high, 7.3 W/cm^3 and $-2.9 \times 10^4 \text{ kJ/mole } H_2$, respectively. This catalytic plasma reaction may represent a new hydrogen energy source and a new field of hydrogen chemistry.

29. R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Characterization of Lithium Chloro Hydride", Int. J. Hydrogen Energy, submitted.

A novel inorganic hydride compound lithium chloro hydride, $LiHCl$, which comprises a high binding energy hydride ion was synthesized by reaction of atomic

hydrogen with potassium metal and lithium chloride. Lithium chloro hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), 1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and powder X-ray diffraction (IC Laboratories, Amawalk, NY). Hydride ions with increased binding energies may form many novel compounds with broad applications such as the oxidant of a high voltage battery.

28. R. Mills, E. Dayalan, P. Ray, B. Dhandapani, J. He, "Highly Stable Novel Inorganic Hydrides from Aqueous Electrolysis and Plasma Electrolysis", *Electrochimica Acta*, Vol. 47, No. 24, (2002), pp. 3909-3926.

After 10^4 hours of continuous aqueous electrolysis with K_2CO_3 as the electrolyte, highly stable novel inorganic hydride compounds such as $KHKHCO_3$ and KH were isolated and identified by time of flight secondary ion mass spectroscopy (ToF-SIMS) (Charles Evans East, East Windsor, NJ). The existence of novel hydride ions was determined using X-ray photoelectron spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA) and solid state magic-angle spinning 1H nuclear magnetic resonance spectroscopy (1H MAS NMR) (Spectral Data Services, Inc., Champaign, IL). A novel ion formed by plasma electrolysis of a K_2CO_3 , Rb_2CO_3 , or Cs_2CO_3 electrolyte was also observed by high resolution visible spectroscopy at 407.0 nm corresponding to its predicted binding energy of 3.05 eV.

27. R. Mills, B. Dhandapani, M. Nansteel, J. He, A. Voigt, "Identification of Compounds Containing Novel Hydride Ions by Nuclear Magnetic Resonance Spectroscopy", *Int. J. Hydrogen Energy*, Vol. 26, No. 9, Sept. (2001), pp. 965-979.

Novel inorganic alkali and alkaline earth hydrides of the formula MH^* , MH_2^* , and MH^*X wherein M is the metal, X , is a halide, and H^* comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell by reaction of

atomic hydrogen with a catalyst and MH , MH_2 , or MX corresponding to an alkali metal or alkaline earth metal compound, respectively. Novel hydride ions of the corresponding novel hydride compounds were characterized by an extraordinary upfield shifted peak observed by 1H nuclear magnetic resonance spectroscopy. The result were confirmed on five different instruments at five independent laboratories (Spectral Data Services, Inc., Champaign, IL, National Research Council of Canada, University of Massachusetts Amherst, Amherst, MA, University of Delaware, Wilmington, DE, and Grace Davison, Columbia, MD).

26. **R. Mills, B. Dhandapani, N. Greenig, J. He, "Synthesis and Characterization of Potassium Iodo Hydride", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1185-1203.**

A novel inorganic hydride compound KHI which comprises a high binding energy hydride ion was synthesized by reaction of atomic hydrogen with potassium metal and potassium iodide. Potassium iodo hydride was identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), 1H and ^{39}K nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), Fourier transform infrared spectroscopy (Surface Science Laboratories, Mountain View, CA), electrospray ionization time of flight mass spectroscopy (Perkin-Elmer Biosystems, Framingham, MA), liquid chromatography/mass spectroscopy (Ricerca, Inc., Painesville, Ohio), thermal decomposition with analysis by gas chromatography, and mass spectroscopy, and elemental analysis (Galbraith Laboratories, Inc., Knoxville, TN). Hydride ions with increased binding energies may form many novel compounds with broad applications.

25. **R. Mills, "Novel Inorganic Hydride", Int. J. of Hydrogen Energy, Vol. 25, (2000), pp. 669-683.**

A novel inorganic hydride compound $KH KHCO_3$ which is stable in water and comprises a high binding energy hydride ion was isolated following the electrolysis of a

K_2CO_3 electrolyte. Inorganic hydride clusters $K[KH KHCO_3]^+$ were identified by Time of Flight Secondary Ion Mass Spectroscopy (Charles Evans East, East Windsor, NJ). Moreover, the existence of a novel hydride ion has been determined using X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and 1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL). Hydride ions with increased binding energies may be the basis of a high voltage battery for electric vehicles.

24. R. Mills, B. Dhandapani, M. Nansteel, J. He, T. Shannon, A. Echezuria, "Synthesis and Characterization of Novel Hydride Compounds", Int. J. of Hydrogen Energy, Vol. 26, No. 4, (2001), pp. 339-367.

Novel inorganic alkali and alkaline earth hydrides of the formula MHX and $MHMX$ wherein M is the metal, X , is a singly negatively charged anion, and H comprises a novel high binding energy hydride ion were synthesized in a high temperature gas cell by reaction of atomic hydrogen with a catalyst and MX or MX_2 corresponding to an alkali metal or alkaline earth metal, respectively. It has been reported that intense extreme ultraviolet (EUV) emission was observed at low temperatures (e.g. $\approx 10^3 K$) from atomic hydrogen and certain atomized elements or certain gaseous ions which ionize at integer multiples of the potential energy of atomic hydrogen, 27.2 eV [1-5]. These atomized elements or certain gaseous ions comprised the catalyst to form MHX and $MHMX$. For example, atomic hydrogen was reacted with strontium vapor and $SrBr_2$ to form $SrHBr$. Novel hydride compounds such as $SrHBr$ were identified by time of flight secondary ion mass spectroscopy, X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), 1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL), and thermal decomposition with analysis by gas chromatography, and mass spectroscopy. Hydride ions with increased binding energies form novel compounds with potential broad applications such as a high voltage battery for consumer electronics and electric vehicles. In addition, these novel compositions of

matter and associated technologies may have far-reaching applications in many industries including chemical, electronics, computer, military, energy, and aerospace in the form of products such as propellants, solid fuels, surface coatings, structural materials, and chemical processes.

23. R. Mills, "Highly Stable Novel Inorganic Hydrides", Journal of New Materials for Electrochemical Systems, Vol. 6, (2003), pp. 45-54.

Novel inorganic hydride compounds $KHKHCO_3$ and KH were isolated following the electrolysis of a K_2CO_3 electrolyte. The compounds which comprised high binding energy hydride ions were stable in water, and KH was stable at elevated temperature (600 °C). Inorganic hydride clusters $K[KHKHCO_3]^+$ were identified by positive Time of Flight Secondary Ion Mass Spectroscopy (ToF-SIMS) of $KHKHCO_3$ (Charles Evans East, East Windsor, NJ). The negative ToF-SIMS was dominated by hydride ion. The positive and negative ToF-SIMS of KH showed essentially K^+ and H^- only, respectively. Moreover, the existence of novel hydride ions was determined using X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), and 1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL). Hydride ions with increased binding energies may be the basis of a high voltage battery for electric vehicles.

22. R. Mills, "Novel Hydrogen Compounds from a Potassium Carbonate Electrolytic Cell", Fusion Technology, Vol. 37, No. 2, March, (2000), pp. 157-182.

Novel compounds containing hydrogen in new hydride and polymeric states which demonstrate novel hydrogen chemistry have been isolated following the electrolysis of a K_2CO_3 electrolyte with the production of excess energy. Inorganic hydride clusters $K[KHKHCO_3]^+$ and hydrogen polymer ions such as OH_{23}^+ and H_{16}^- were identified by time of flight secondary ion mass spectroscopy (Charles Evans East, East Windsor, NJ). The presence of compounds containing new states of hydrogen were

confirmed by X-ray photoelectron spectroscopy (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA), X-ray diffraction, Fourier transform infrared spectroscopy (Surface Science Laboratories, Mountain View, CA), Raman spectroscopy (Environmental Catalysis and Materials Laboratory of Virginia Polytechnic Institute), and ^1H nuclear magnetic resonance spectroscopy (Spectral Data Services, Inc., Champaign, IL).

21. Mills, R., Good, W., "Fractional Quantum Energy Levels of Hydrogen", *Fusion Technology*, Vol. 28, No. 4, November, (1995), pp. 1697-1719.

Determination of excess heat release during the electrolysis of aqueous potassium carbonate by the very accurate and reliable method of heat measurement, flow calorimetry; describes the experimental identification of hydrogen atoms in fractional quantum energy levels—hydrinos—by X-ray Photoelectron Spectroscopy (XPS) (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA); describes the experimental identification of hydrogen atoms in fractional quantum energy levels—hydrinos—by emissions of soft X-rays from dark matter; describes the experimental identification of hydrogen molecules in fractional quantum energy levels—dihydrino molecules by high resolution magnetic sector mass spectroscopy with ionization energy determination, and gives a summary.

In summary:

Excess power and heat were observed during the electrolysis of aqueous potassium carbonate. Flow calorimetry of pulsed current electrolysis of aqueous potassium carbonate at a nickel cathode was performed in a single-cell dewar. The average power out of 24.6 watts exceeded the average input power (voltage times current) of 4.73 watts by a factor greater than 5. The total input energy (integration of voltage times current) over the entire duration of the experiment was 5.72 MJ; whereas, the total output energy was 29.8 MJ. No excess heat was observed when the electrolyte was changed from potassium carbonate to sodium carbonate. The source of heat is assigned to the electrocatalytic, exothermic reaction whereby the electrons of hydrogen atoms are induced to undergo transitions to quantized energy levels below

the conventional "ground state". These lower energy states correspond to fractional quantum numbers: $n = 1/2, 1/3, 1/4, \dots$. Transitions to these lower energy states are stimulated in the presence of pairs of potassium ions (K^+/K^+ electrocatalytic couple) which provide 27.2 eV energy sinks.

The identification of the $n = 1/2$ hydrogen atom, $H(n = 1/2)$ is reported. Samples of the nickel cathodes of aqueous potassium carbonate electrolytic cells and aqueous sodium carbonate electrolytic cells were analyzed by XPS (Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA). A broad peak centered at 54.6 eV was present only in the cases of the potassium carbonate cells. The binding energy (in vacuum) of $H(n = 1/2)$ is 54.4 eV. Thus, the theoretical and measured binding energies for $H(n = 1/2)$ are in excellent agreement.

Further experimental identification of hydrinos—down to $H(n = 1/8)$ —can be found in the alternative explanation by Mills et al. for the soft X-ray emissions of the dark interstellar medium observed by Labov and Bowyer [Labov, S., Bowyer, S., "Spectral observations of the extreme ultraviolet background", *The Astrophysical Journal*, 371, (1991), pp. 810-819] of the Extreme UV Center of the University of California, Berkeley. The agreement between the experimental spectrum and the energy values predicted for the proposed transitions is remarkable.

The reaction product of two $H(n=1/2)$ atoms, the dihydrino molecule, was identified by mass spectroscopy (Shrader Analytical & Consulting Laboratories). The mass spectrum of the cryofiltered gases evolved during the electrolysis of a light water K_2CO_3 electrolyte with a nickel cathode demonstrated that the dihydrino molecule, $H_2\left(n = \frac{1}{2}\right)$, has a higher ionization energy, about 63 eV, than normal molecular hydrogen, $H_2(n = 1)$, 15.46 eV. The high resolution (0.001 AMU) magnetic sector mass spectroscopic analysis of the postcombustion gases indicated the presence of two peaks of nominal mass two-- one peak at 70 eV and one peak at 25 eV. The same analysis of molecular hydrogen indicates only one peak at 25 eV and one peak at 70 eV. In the case of the postcombustion sample at 70 eV, one peak was assigned as the

hydrogen molecular ion peak, $H_2^+(n=1)$, and one peak was assigned as the dihydrino molecular peak, $H_2^+\left(n=\frac{1}{2}\right)$ which has a slightly larger magnetic moment.

20. Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994).

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed by Thermacore, Inc., Lancaster, PA. The excess power out of 41 watts exceeded the total input power given by the product of the electrolysis voltage and current by a factor greater than 8. Elemental analysis of the electrolyte and metallurgical analysis of the cathode showed no evidence of chemical reactions. The pH, specific gravity, concentration of K_2CO_3 , and the elemental analysis of the electrolyte sample taken after 42 days of continuous operation were unchanged from that of the values obtained for the electrolyte sample taken before operation. Elemental analysis and scanning electron microscopy of metallurgical samples of the nickel cathode taken before operation and at day 56 of continuous operation were identical indicating that the nickel cathode had not changed chemically or physically. Scintillation counter and photographic film measurements showed that no radiation above background was detected indicating that nuclear reactions did not occur.

The "ash" of the exothermic reaction is atoms having electrons of energy below the "ground state" which are predicted to form molecules. The predicted molecules were identified by lack of reactivity with oxygen, by separation from molecular deuterium by cryofiltration, and by mass spectroscopic analysis. The combustion of the gases evolved during the electrolysis of a light water K_2CO_3 electrolyte (K^+/K^+ electrocatalytic couple) with a nickel cathode was incomplete. The mass spectroscopic analysis (Dr. David Parees of Air Products & Chemicals, Inc.) of the $m/e = 2$ peak of the combusted gas demonstrated that the dihydrino molecule, $H_2(n = 1/2)$, has a higher ionization energy than H_2 .

Calorimetry of pulsed current and continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cells by HydroCatalysis Power Corporation. Excess power out exceeded input power by a factor greater than 16. No excess heat was observed when the electrolyte was changed from potassium carbonate to the control sodium carbonate. The faraday efficiency was measured volumetrically to be 100%.

19. V. Noninski, Fusion Technol., Vol. 21, 163 (1992).

Dr. Noninski of the Laboratory for Electrochemistry of Renewed Electrode-Solution Interface (LEPGER) successfully reproduced the results of Mills and Kneizys [R. Mills and S. Kneizys, Fusion Technol. Vol. 20, 65 (1991)] as a visiting professor at Franklin and Marshall College. A significant increase in temperature with every watt input, compared with the calibration experiment ($\approx 50^\circ C/W$ versus $\approx 30^\circ C/W$), was observed during the electrolysis of potassium carbonate. This effect was not observed when sodium carbonate was electrolyzed. No trivial explanation (in terms of chemical reactions, change in heat transfer properties, etc.) of this effect were found.

18. Niedra, J., Meyers, I., Fralick, G. C., and Baldwin, R., "Replication of the Apparent Excess Heat Effect in a Light Water-Potassium Carbonate-Nickel Electrolytic Cell, NASA Technical Memorandum 107167, February, (1996). pp. 1-20.; Niedra, J., Baldwin, R., Meyers, I., NASA Presentation of Light Water Electrolytic Tests, May 15, 1994.

NASA Lewis tested a cell identical to that of Thermacore [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] with the exception that it was minus the central cathode. A cell identical to the test cell with heater power only (no electrolysis) was the calibration control and the blank cell with the heater power equal to zero. The test cell was also calibrated "on the fly" by measuring the temperature relative to the blank cell at several values of heater input power of the test cell. "Replication of experiments claiming to demonstrate excess heat production in light water-Ni- K_2CO_3 electrolytic cells was found to produce an

apparent excess heat of 11 W maximum, for 60 W electrical power into the cell. Power gains ranged from 1.06 to 1.68." The production of excess energy with a power gain of 1.68 would require 0% Faraday efficiency to account for the observed excess power.

17. Technology Insights, 6540 Lusk Boulevard, Suite C-102, San Diego, CA 92121, "HydroCatalysis Technical Assessment Prepared for PacifiCorp", August 2, 1996.

This report documents a technical assessment of a novel source of hydrogen energy advanced by HydroCatalysis Power Corporation now BlackLight Power, Inc. (BLP). The assessment was conducted as part of the due diligence performed for PacifiCorp. It was conducted by a literature search and review, site visits to BLP and collaborating organizations, and telephone interviews with others active in the general area. A description of concept is provided in Section 3. Section 4 presents an assessment of the concept background, supporting theory, laboratory prototypes, projected initial products, and economic and environmental aspects. Section 5 documents the results of telephone interviews and site visits. An overall summary and conclusions are presented in the following section.

16. P. M. Jansson, "HydroCatalysis: A New Energy Paradigm for the 21st Century", Thesis Submitted in partial fulfillment of the requirements of the Masters of Science in Engineering Degree in the Graduate Division of Rowan University, May 1997, Thesis Advisors: Dr. J. L. Schmalzel, Dr. T. R. Chandrupatla, and Dr. A. J. Marchese, External Advisors: Dr. J. Phillips, Pennsylvania State University, Dr. R. L. Mills, BlackLight Power, Inc., W. R. Good, BlackLight Power, Inc.

This thesis reviews the problems of worldwide energy supply, describes the current technologies that meet the energy needs of our industrial societies, summarizes the environmental impacts of those fuels and technologies and their increased use by a growing global and increasing technical economy. The work also describes and advances the technology being developed by BlackLight Power, Inc. (BLP) a scientific company located in Princeton, New Jersey. BLP's technology proports to offer

commercially viable and useful heat generation via a previously unrecognized natural phenomenon - the catalytic reduction of the hydrogen atom to a lower energy state. Laboratory tests obtained as original research of this thesis as well as the review of the data of others substantiate the fact that replication of the experimental conditions which are favorable to initiating and sustaining the new energy release process will generate controllable, reproducible, sustainable and commercial meaningful heat. For example, Jansson has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills hydrino formation hypothesis. Approximately 10^{-3} moles of hydrogen was admitted to a 20 cm^3 Calvet cell containing a heated platinum filament and KNO_3 powder. In the three separate trials with a platinum filament hydrogen dissociator which was varied in length of 10 cm, 20 cm, and 30 cm, a mean power of 0.581, 0.818, and 1.572 watts was observed, respectively. The closed experiments were run to completion. The energy observed was 622, 369, and 747 kJ, respectively. This is equivalent to the generation of $6.2 \times 10^8\text{ J/mole}$, $3.7 \times 10^8\text{ J/mole}$, and $7.5 \times 10^8\text{ J/mole}$ of hydrogen, respectively, as compared to $2.5 \times 10^5\text{ J/mole}$ of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be at least 1000 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills model. Convincing evidence is presented to lead to the conclusion that BLP technology has tremendous potential to achieve commercialization and become an energy paradigm for the next century. The research was also conducted as part of the due diligence performed for Atlantic Energy now Conectiv.

15. **Phillips, J., Smith, J., Kurtz, S., "Report On Calorimetric Investigations Of Gas-Phase Catalyzed Hydrino Formation" Final report for Period October-December 1996", January 1, 1997, A Confidential Report submitted to BlackLight Power, Inc. provided by BlackLight Power, Inc., Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined heat production associated with hydrino formation with a Calvet calorimeter which yielded exceptional results. Specifically, the results are completely consistent with Mills hydrino formation hypothesis. In three separate trials, between 10 and 20 K Joules were generated at a rate of 0.5 Watts, upon admission of approximately 10^{-3} moles of hydrogen to the 20 cm^3 Calvet cell containing a heated platinum filament and KNO_3 powder. This is equivalent to the generation of 10^7 J/mole of hydrogen, as compared to $2.5 \times 10^5 \text{ J/mole}$ of hydrogen anticipated for standard hydrogen combustion. Thus, the total heats generated appear to be 100 times too large to be explained by conventional chemistry, but the results are completely consistent with Mills model.

14. Phillips, J., Shim, H., "Additional Calorimetric Examples of Anomalous Heat from Physical Mixtures of K/Carbon and Pd/Carbon", January 1, 1996, A Confidential Report submitted to HydroCatalysis Power Corporation provided by HydroCatalysis Power Corporation, Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.

Pennsylvania State University Chemical Engineering Department has determined excess heat release from flowing hydrogen in the presence of ionic hydrogen spillover catalytic material: 40% by weight potassium nitrate (KNO_3) on graphitic carbon powder with 5% by weight 1%-Pd-on-graphitic carbon (K^+/K^+ electrocatalytic couple) by the very accurate and reliable method of heat measurement, thermopile conversion of heat into an electrical output signal. Excess power and heat were observed with flowing hydrogen over the catalyst. However, no excess power was observed with flowing helium over the catalyst mixture. Rates of heat production were reproducibly observed which were higher than that expected from the conversion of all the hydrogen entering the cell to water, and the total energy observed was over four times larger than that expected if all the catalytic material in the cell were converted to the lowest energy state by "known" chemical reactions. Thus, "anomalous" heat, heat of a magnitude and duration which could not be explained by conventional chemistry, was reproducibly observed.

- 13. Bradford, M. C., Phillips, J., "A Calorimetric Investigation of the Reaction of Hydrogen with Sample PSU #1", September 11, 1994, A Confidential Report submitted to HydroCatalysis Power Corporation provided by HydroCatalysis Power Corporation, Great Valley Corporate Center, 41 Great Valley Parkway, Malvern, PA 19355.**

Pennsylvania State University Chemical Engineering Department has determined excess heat release from flowing hydrogen in the presence of nickel oxide powder containing strontium niobium oxide ($\text{Nb}^{3+}/\text{Sr}^{2+}$ electrocatalytic couple) by the very accurate and reliable method of heat measurement, thermopile conversion of heat into an electrical output signal. Excess power and heat were observed with flowing hydrogen over the catalyst which increased with increasing flow rate. However, no excess power was observed with flowing helium over the catalyst/nickel oxide mixture or flowing hydrogen over nickel oxide alone. Approximately 10 cc of nickel oxide powder containing strontium niobium oxide immediately produced 0.55 W of steady state output power at 523 K. When the gas was switched from hydrogen to helium, the power immediately dropped. The switch back to hydrogen restored the excess power output which continued to increase until the hydrogen source cylinder emptied at about the 40,000 second time point. With no hydrogen flow the output power fell to zero.

The source of heat is assigned to the electrocatalytic, exothermic reaction whereby the electrons of hydrogen atoms are induced to undergo transitions to quantized energy levels below the conventional "ground state". These lower energy states correspond to fractional quantum numbers: $n = 1/2, 1/3, 1/4, \dots$. Transitions to these lower energy states are stimulated in the presence of pairs of niobium and strontium ions ($\text{Nb}^{3+}/\text{Sr}^{2+}$ electrocatalytic couple) which provide 27.2 eV energy sinks.

- 12. Jacox, M. G., Watts, K. D., "The Search for Excess Heat in the Mills Electrolytic Cell", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, January 7, 1993.**

Idaho National Engineering Laboratory (INEL) operated a cell identical to that of Thermacore [Mills, R., Good, W., Shaubach, R., "Dihydrino Molecule Identification", Fusion Technology, Vol. 25, 103 (1994)] except that it was minus the central cathode and that the cell was wrapped in a one-inch layer of urethane foam insulation about the cylindrical surface. The cell was operated in a pulsed power mode. A current of 10 amperes was passed through the cell for 0.2 seconds followed by 0.8 seconds of zero current for the current cycle. The cell voltage was about 2.4 volts, for an average input power of 4.8 W. The electrolysis power average was 1.84 W, and the stirrer power was measured to be 0.3 W. Thus, the total average net input power was 2.14 W. The cell was operated at various resistance heater settings, and the temperature difference between the cell and the ambient as well as the heater power were measured. The results of the excess power as a function of cell temperature with the cell operating in the pulsed power mode at 1 Hz with a cell voltage of 2.4 volts, a peak current of 10 amperes, and a duty cycle of 20 % showed that the excess power is temperature dependent for pulsed power operation, and the maximum excess power was 18 W for an input electrolysis joule heating power of 2.14 W. Thus, the ratio of excess power to input electrolysis joule heating power was 850 %. INEL scientists constructed an electrolytic cell comprising a nickel cathode, a platinized titanium anode, and a 0.57 M K_2CO_3 electrolyte. The cell design appears in Appendix 1. The cell was operated in the environmental chamber in the INEL Battery Test Laboratory at constant current, and the heat was removed by forced air convection in two cases. In the first case, the air was circulated by the environmental chamber circulatory system alone. In the second case, an additional forced air fan was directed onto the cell. The cell was equipped with a water condenser, and the water addition to the cell due to electrolysis losses was measured. The data of the forced convection heat loss calorimetry experiments during the electrolysis of a 0.57 M K_2CO_3 electrolyte with the INEL cell showed that 13 W of excess power was produced. This excess power could not be attributed to recombination of the hydrogen and oxygen as indicated by the equivalence of the calculated and measured water balance.

11. Peterson, S., H., Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC, 1310 Beulah Road, Pittsburgh, PA, February 25, 1994.

Westinghouse Electric Corporation reports that excess heat was observed during the electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) where the electrolysis of aqueous sodium carbonate served as the control. The data of the temperature of the cell minus the ambient temperature shows that when potassium carbonate replaced sodium carbonate in the same cell with the same input electrolysis power, the potassium experiment was twice as hot as the sodium carbonate experiment for the duration of the experiment, one month. The net faraday efficiency of gas evolution was experimentally measured to be unity by weighing the experiment to determine that the expected rate of water consumption was observed. The output power exceeded the total input power. The data was analyzed by HydroCatalysis Power Corporation [Mills, R., Analysis by HydroCatalysis Power Corporation of Westinghouse Report Entitled "Evaluation of Heat Production from Light Water Electrolysis Cells of HydroCatalysis Power Corporation, Report from Westinghouse STC", February 25, 1994].

10. Haldeman, C. W., Savoye, G. W., Iseler, G. W., Clark, H. R., MIT Lincoln Laboratories Excess Energy Cell Final report ACC Project 174 (3), April 25, 1995.

During the electrolysis of aqueous potassium carbonate, researchers working at MIT Lincoln Laboratories observed long duration excess power of 1-5 watts with output/input ratios over 10 in some cases with respect to the cell input power reduced by the enthalpy of the generated gas. In these cases, the output was 1.5 to 4 times the integrated volt-ampere power input. Faraday efficiency was measured volumetrically by direct water displacement.

9. Craw-Ivanco, M. T.; Tremblay, R. P.; Boniface, H. A.; Hilborn, J. W.;
"Calorimetry for a Ni/K_2CO_3 Cell", Atomic Energy Canada Limited, Chemical

Engineering Branch, Chalk River Laboratories, Chalk River, Ontario, June 1994.

Atomic Energy Canada Limited, Chalk River Laboratories, report that 128 % and 138% excess heat were observed in separate experiments by flow calorimetry during the electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) in a closed cell, and that 138% was observed in an open cell.

8. Shaubach, R. M., Gernert, N. J., "Anomalous Heat From Hydrogen in Contact with Potassium Carbonate", Thermacore Report, March 1994.

A high temperature/high pressure/high power density industrial prototype gas cell power generator which produced 50 watts of power at 300 °C having a nickel surface area of only 300 cm² was successfully developed. A sample of the nickel tubing of the aqueous potassium carbonate permeation cell was analyzed by XPS at the Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA. A broad peak centered at 54.6 eV was present; whereas, the control nickel tube showed no feature. The binding energy (in vacuum) of $H(n = 1/2)$ is 54.4 eV. Thus, the theoretical and measured binding energies for $H(n = 1/2)$ are in excellent agreement. No excess energy or 54.6 eV feature were observed when sodium carbonate replaced potassium carbonate.

7. Gernert, N., Shaubach, R. M., Mills, R., Good, W., "Nascent Hydrogen: An Energy Source," Final Report prepared by Thermacore, Inc., for the Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base, Contract Number F33615-93-C-2326, May, (1994).

In a report prepared for the Aero Propulsion and Power Directorate, Wright Laboratory, Air Force Material Command (ASC), Wright-Patterson Air Force Base, Thermacore reports, "anomalous heat was observed from a reaction of atomic hydrogen in contact with potassium carbonate on a nickel surface. The nickel surface consisted of 500 feet of 0.0625 inch diameter tubing wrapped in a coil. The coil was inserted into a pressure vessel containing a light water solution of potassium carbonate. The tubing

and solution were heated to a steady state temperature of 249 °C using an I²R heater. Hydrogen at 1100 psig was applied to the inside of the tubing. After the application of hydrogen, a 32 °C increase in temperature of the cell was measured which corresponds to 25 watts of heat. Heat production under these conditions is predicted by the theory of Mills where a new species of hydrogen is produced that has a lower energy state than normal hydrogen. ESCA analysis, done independently by Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, have found the predicted 55 eV signature of this new species of hydrogen."

6. Wiesmann, H., Brookhaven National Laboratory, Department of Applied Science, Letter to Dr. Walter Polansky of the Department of Energy Regarding Excess Energy Verification at Brookhaven National Laboratory, October 16, 1991.

Calorimetry of continuous electrolysis of aqueous potassium carbonate (K^+/K^+ electrocatalytic couple) at a nickel cathode was performed in single cell dewar calorimetry cell by Noninski at Brookhaven National Laboratory. Dr. Weismann observed the experiment and reported the results to Dr. Walter Polansky of the U. S. Department of Energy. Dr. Weismann reports, "The claim is as follows. The temperature rise in the dewar is greater in the case of electrolysis as compared to using a resistor, even though the power dissipated is equal in both cases. According to Dr. Mills' theory, this apparent "excess power" is due to the fact that the electron in a hydrogen atom can "decay" to stable subinterger quantum levels. Dr. Noninski demonstrated this thermal effect at BNL." The observed rise in temperature for a given input power was twice as high comparing electrolysis versus heater power.

5. Nesterov, S. B., Kryukov, A. P., Moscow Power Engineering Institute Affidavit, February, 26,1993.

The Moscow Power Engineering Institute experiments showed 0.75 watts of heat output with only 0.3 watts of total power input (power = VI) during the electrolysis of an aqueous potassium carbonate electrolyte with a nickel foil cathode and a platinized

titanium anode. Excess power over the total input on the order of 0.45 watts was produced reliably and continuously over a period of three months. Evaluation of the electrolyte after three months of operation showed no significant change in its density or molar concentration. The cell was disassembled and inspected after over one month of operation at 0.1 amperes. This inspection showed no visible signs of a reaction between the electrodes and the electrolyte. The cell was re-assembled and operated as before. Excess energy was produced for the three month duration of the experiment. Scintillation counter measurements showed no signs of radiation external to the cell.

4. Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University Bethlehem, PA, November 1993.

Samples of the nickel cathodes of aqueous potassium carbonate electrolytic cells and aqueous sodium carbonate electrolytic cells were analyzed by XPS by Miller and Simmons of the Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA. A broad peak centered at 54.6 eV was present only in the cases of the potassium carbonate cells. The binding energy (in vacuum) of $H(n = 1/2)$ is 54.4 eV. Thus, the theoretical and measured binding energies for $H(n = 1/2)$ are in excellent agreement. Lehigh University has conducted an extensive investigation of the cathodes from heat producing as well as those from control cells. Miller concludes that "I was unable to find any other elements on the surface that cause the feature. The persistent appearance of a spectral feature near the predicted binding energy for many of the electrodes used with a K electrolyte is an encouraging piece of evidence for the existence of the reduced energy state hydrogen".

3. Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993.

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at

Idaho National Engineering Laboratory (INEL). Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA [Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994]. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells [Craig, A., Y., Charles Evans & Associates XPS/ESCA Results, CE&A Number 44545, November 3, 1994]. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

2. Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994.

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL) [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415,

November 1993]. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

1. Craig, A., Y., Charles Evans & Associates XPS/ESCA Results, CE&A Number 44545, November 3, 1994.

The Lehigh XPS results of a broad peak centered at 54.6 eV present only in the cases of the potassium carbonate cells [Miller, A., Simmons, G., Lehigh X-Ray Photoelectron Spectroscopy Report, Zettlemoyer Center for Surface Studies, Sinclair Laboratory, Lehigh University, Bethlehem, PA, November 1993] were confirmed at Idaho National Engineering Laboratory (INEL) [Jacox, M. G., Watts, K. D., "INEL XPS Report", Idaho National Engineering Laboratory, EG&G Idaho, Inc., Idaho Falls, Idaho, 83415, November 1993]. Samples which demonstrated the feature as well as control electrodes were tested for the presence of trace amounts of impurities of the elements iron and lithium at a sensitivity level of greater than 1000 times that of XPS. TOF-SIMS (Time of Flight-Secondary Ion Mass Spectroscopy) and XPS analysis of the nickel surface was performed by Charles Evans & Associates, Sunnyvale, CA [Lee, Jang-Jung, Charles Evans & Associates Time-Of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) Surface Analysis Report, CE&A Number 40150, March 18, 1994]. The 54.6 eV feature was also observed by Charles Evans & Associates in the case of cathodes of potassium carbonate electrolytic cells. Iron and lithium were the only remaining atoms which were in question by Lehigh University and INEL as the source of the 54.6 eV XPS peak. The Charles Evans TOF-SIMS results demonstrate that iron and lithium were not the source of this peak.

Given Applicant's full compliance with the new standards imposed by Specialist McGinty during the February 11, 2003 Interview, which required independent validation of the experimental evidence of record, Applicant is entitled to have this evidence accepted as reliable and to have this and other BlackLight applications issue as patents.

Applicant's Response Documenting Examiner Langel's Reaffirmation of the Utility and Operability of Applicant's Novel Hydrogen Technology and His Subsequent Removal From Examining All BlackLight Cases

Pursuant to representations and agreements made during the February 11 Interview (reprinted below), Applicant followed up with the submission of much of the above scientific evidence in two copending BlackLight applications by arranging an Interview with Examiner Langel, who was assigned to those cases. [U.S. Serial Nos. 09/110,678 ('678 application) and 09/362,693 ('693 application).] The express purpose of the Interview, held on April 14, 2003, was to review those two applications on a claim-by-claim basis to ensure that the scientific data presented adequately supported the scope of the claims. Examiner Langel expressed once again his view that the claims of the two applications were adequately supported by the data and, therefore, those claims were allowable.

A detailed account of the discussions Applicant's counsel, Jeffrey Melcher and Jeffrey Simenauer, had with Examiner Langel during the April 14, 2003 Interview, and with Examiner Langel and his supervisor, SPE Stanley Silverman, during follow-up telephone Interviews were documented in Supplemental Responses filed in the '678 and '693 applications, comments from which are reproduced below. Based on the shocking revelations divulged during these discussions, Applicant must once again protest in the strongest terms possible the manner in which an anonymous group of PTO officials (*i.e.*, the "Secret Committee") has mishandled the examination of BlackLight's patent applications relating to Applicant's novel hydrogen technology.

Counsel was particularly distressed to learn that when Examiner Langel met with Supervisor Silverman to advocate allowing the '678 and '693 applications to issue as patents, his supervisor informed him that "allowance is not an option." Despite the Examiner's careful study of the overwhelming weight of the scientific data supporting allowance, his supervisor further instructed him to "make it appear as if you have authority [to allow the applications] and that you are in favor of full rejection."

Understandably, Examiner Langel felt uneasy having been asked to make representations on the record that were not true. He explained that, "for moral and ethical reasons," he had no choice but to allow himself to be removed from examining all assigned

BlackLight applications. Although Supervisor Silverman admitted that the removal decision had been made "partially by [him] and partially by others," he would not reveal who those "others" were.

Applicant strongly objects to Examiner Langel's removal under these egregious circumstances and demands that the PTO reinstate him immediately and allow BlackLight's applications to issue. The Secret Committee is duty bound to honor the representations and agreements made by Quality Assurance Specialist Douglas McGinty during the February 11, 2003 Interview, declaring that:

- (1) Examiner Langel and the other Examiners of record have "full authority" to review the scientific data supporting lower energy states of hydrogen generated and furnished by independent third parties and, based on that review, to issue patents as deemed appropriate;
- (2) Applicant should confer with the Examiners, either by telephone or in person, to review each assigned application on a claim-by-claim basis to ensure that the scientific data presented adequately supports the scope of the claims; and
- (3) for those claims determined to be adequately supported by the data, a patent will issue; for any claims deemed to be inadequately supported, Applicant reserves the right to continue seeking that broader claim coverage in subsequent proceedings. [See March 6, 2003 Response filed in the '678 application]

It was precisely because of the many prior abuses that led to this short-lived "breakthrough" that U.S. Congressman David Wu sent his Senior Legislative Assistant, Ted Liu, to attend the February 11 Interview. Prior to the Interview, a senior PTO official alleged to Mr. Liu that there was no "Secret Committee." At the Interview, Mr. Liu witnessed not only Specialist McGinty's representation that Examiner Langel had the authority to allow BlackLight's applications, but the Examiner's unequivocal statement that the applications were, in fact, allowable and that he was prepared to issue Applicant his patents right then and there. [See supra and Attachment P]

Despite those representations, an anonymous group of individuals has now declared that allowance is not even an option in BlackLight's cases. Worse yet, this Secret Committee sought to leave the false impression on the record that Examiner

Langel—and perhaps other Examiners of record—had the authority to allow BlackLight's applications, and that he favored the rejection of claims over allowance.

In view of this unfortunate incident, which is described in greater detail below, Applicant is entitled to a complete accounting of events leading to Examiner Langel's removal, including identification of all persons involved in making that decision.

Detailed Account of the April 14, 2003 Interview and Subsequent Discussions

As stated above, the express purpose of the April 14, 2003 Interview was to review the scientific data generated and furnished by independent third parties identified in the March 6, 2003 Response that was filed in the '678 and '693 applications in support of the lower energy states of hydrogen and to ensure that the data adequately supported the scope of the claims to secure their allowance.

Applicant had no reason to suspect that this approach, as agreed to during the prior February 11, 2003 Interview, was about to be completely scrapped. During the subsequent April 14, 2003 Interview, Examiner Langel once again reaffirmed his long-held opinion that the scientific data demonstrated the operability of Applicant's novel hydrogen technology, thus warranting patent protection. The Examiner's comments made clear that, prior to the interview, he had extensively reviewed Applicant's data, as well as the summary statements characterizing that data, appearing in the prior Responses filed in the '678 and '693 applications. Based on that review, Examiner Langel expressed several times during the Interview his willingness to allow those cases. Those views were confirmed by the Examiner in his interview summary, which stated that "[t]he participants presented data establishing the existence of lower-energy hydrogen." [See April 14, 2003 Interview Summary Form filed in the '678 and '693 applications (Attachment F).]

Examiner Langel, however, refrained from indicating allowance of any specific claims for two stated reasons. First, a few items of submitted data summarized in the March 6 Response inexplicably could not be located in the PTO files. The Examiner wanted time to confirm the data had been made of record, as well as Applicant's description of its relevance. Second, despite Specialist McGinty's representation at the February 11 Interview that Examiner Langel had full authority to review the data and to

issue claims in this case, the Examiner explained that he needed to advise him and Supervisor Silverman of his intention to do so.

Examiner Langel then recalled a recent visit to his office by Group Director Jacqueline Stone informing him—again, contrary to what Applicant was told at the February 11, 2003 Interview—that he did not have authority to issue Notices of Allowance, or to otherwise give indications of allowance, in any BlackLight applications. Director Stone instructed Examiner Langel that he would need Specialist McGinty's permission before so indicating allowance.

Examiner Langel did, however, note that Supervisor Silverman and Specialist McGinty had agreed before the February 11 Interview to allow claims if Applicant could show that his submitted scientific data was generated by independent third parties. The Examiner reassured counsel that he would present to his superiors the scientific data discussed at the April 14 Interview with a recommendation of allowance consistent with his past views.

Applicant's counsel agreed that it made sense to allow time for Examiner Langel to discuss the case with his superiors and for counsel to resubmit the few missing items of scientific data, whereupon arrangement was made to continue with the personal Interview on the following day, April 15th. That morning, however, counsel received a distressing telephone message from Examiner Langel informing him that the Interview had been canceled. The Examiner stated that Supervisor Silverman had removed him from the subject cases and that he was no longer assigned to any BlackLight applications.

Applicant's counsel immediately telephoned Examiner Langel for a further explanation of what had happened. The Examiner confirmed his removal following the meeting he had arranged with Supervisor Silverman to discuss the scientific data that had been the subject of the previous day's Interview and to advocate allowance of the claims in the two subject applications. Examiner Langel informed counsel that his supervisor refused to even look at the data and, in response to his recommendation of allowance, Supervisor Silverman told him "allowance is not an option." According to Examiner Langel he was then told: "Make it appear as if you have authority [to allow the applications] and that you are in favor of full rejection."

Examiner Langel explained that, regrettably, he had no choice but to resign from further examination of BlackLight's applications. According to the Examiner, Supervisor Silverman gave him the option of staying on, "but not really—I could not go on like this." He explained that "for moral and ethical reasons," he could no longer continue to examine his assigned cases.

Alarmed by this sudden turn of events, counsel called Supervisor Silverman the following day, April 16th, to object to Examiner Langel's removal and to seek his reinstatement. Supervisor Silverman confirmed that Examiner Langel would no longer be examining Blacklight's patent applications and that all cases were in the process of being consolidated and transferred to a new Examiner.

Counsel kindly requested that Supervisor Silverman explain why those cases were being transferred and who made that decision. He initially refused to discuss the matter, saying only that, "I am not going to be put on the stand and cross examined on this." Upon further prodding, Supervisor Silverman volunteered that "the decision was made partially by me and partially by others." He refused, however, to be more specific when asked to identify the "others" involved in the decision, stating "I am not going to discuss that. You can say that it was *my* decision."

Counsel then informed Supervisor Silverman of Applicant's intention to file an objection to Examiner Langel's removal and to the consolidation and transfer of BlackLight's applications to a new Examiner. Counsel explained that Applicant had expended enormous amounts of time and money over a period of many years prosecuting BlackLight's patent applications before Examiner Langel and getting him up to speed on the claimed technology and the extensive scientific data confirming its operation. Counsel argued that it was unfair now to remove Examiner Langel and transfer all of BlackLight's cases to a new Examiner just to begin the process all over again. Supervisor Silverman would hear none of it, again stating, "I'm not going to discuss it."

Applicant's counsel made one last attempt to learn the identity of the other PTO officials responsible for taking that drastic action and their reasons for doing so. Supervisor Silverman again refused this request for information, snapping at counsel, "You figure it out!" Counsel then asked the Supervisor whom they might talk to so they

could "figure it out" as he put it. Supervisor Silverman advised counsel, "Talk to whomever you want," but when asked whom specifically he had in mind, he again retorted, "I don't like to be cross-examined."¹¹⁰

At the end of the conversation, Supervisor Silverman attempted to justify the PTO's extreme actions by claiming that it was in the "best interest" to transfer the applications. But, when asked by counsel whose best interest was being served by the transfer, he refused to answer. Instead, Supervisor Silverman offered a stunning revelation that Applicant's novel hydrogen technology was "beyond Examiner Langel's technical expertise" and that all of the BlackLight cases would be consolidated and transferred to another examiner with "more technical expertise." He would not elaborate on who this new, more highly qualified Examiner might be.¹¹¹

Needless to say, at no time during the five years Applicant has been prosecuting his patent applications before Examiner Langel—who has over thirty years of Patent Office experience—did his technical expertise ever come into question. Indeed, throughout the lengthy prosecution of these cases, counsel has been impressed with the Examiner's in-depth knowledge of chemistry and physics, as well as other scientific principles, underlying Applicant's novel hydrogen technology. That Supervisor Silverman would raise Examiner Langel's technical competence as an issue at such a late stage of that prosecution only heightens Applicant's suspicions as to the real motivation for removing Examiner Langel.

Immediately following the conversation with Supervisor Silverman, counsel telephoned Examiner Langel one last time to apprise him of the situation and to thank him for his many years of service in examining BlackLight's applications. Examiner Langel expressed regret over his removal from those cases and confirmed that he had

¹¹⁰ Counsel has taken steps "to figure it out" and expressly reserves the right to further supplement the objections raised herein as additional facts come to light. (Attachment R)

¹¹¹ Supervisor Silverman's statement that all of BlackLight's applications were being consolidated and transferred to a single, more qualified Examiner turned out to be untrue. In fact, Applicant's cases currently remain spread between four named Examiners, not one: Examiners Kalafut, Tsang-Foster, Wells, and Wayner. The only other identified Examiner, who has contributed significant arguments forming the basis for the Committee's rejections in the name of those Examiners, is Dr. Bernard Souw. Dr. Souw's involvement in examining BlackLight's cases while engaged in questionable outside business activities is the subject of more detailed discussions below.

"learned a lot about [BlackLight's] technology." The Examiner also expressed surprise that his expertise was now being called into question.

Examiner Langel shared counsel's exasperation over the situation. Counsel asked him if he knew of any other instances in which a PTO Examiner had been instructed to represent that he had authority to allow an application when, in fact, he had no such authority, and that he favored rejecting claims when he actually wanted to allow them. The Examiner's exact words were: "I've never seen anything like it."

Frankly, neither has Applicant's counsel and, in view of these unique circumstances, Applicant must once again strenuously object to the abusive treatment to which his applications have been subjected.

Demand for Information and Redress

Applicant believes that the totality of events documented above are highly relevant to the PTO's examination of all of BlackLight's patent applications and accurately describe the detrimental effects that examination has had on Applicant's patent rights. These events further demonstrate the PTO's failure to provide adequate safeguards to the interests of Applicant, including fair and expeditious examination, as contemplated by the Federal Circuit in its June 28, 2002 Decision. Applicant therefore respectfully demands that the PTO provide certain information and redress, including:

- 1) identification of all Examiners or other PTO personnel who were consulted, or otherwise provided input, in the examination of BlackLight's applications;
- 2) identification of all outside consultants or other persons who were consulted, or otherwise provided input, in the examination of BlackLight's applications;
- 3) identification of all PTO officials responsible for withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding that withdrawal action;
- 4) identification of all outside sources of information who may have precipitated, or otherwise contributed to, the PTO withdrawing BlackLight's five allowed applications from issuance and a complete disclosure of the facts and circumstances surrounding those actions;

- 5) a complete disclosure of the facts and circumstances surrounding the removal of Examiner Langel from examining BlackLight's applications and the transfer those cases to a new Examiner, including, but not limited to, identification of all persons involved these incidents;
- 6) immediate reinstatement of Examiner Langel to his position as the Examiner of record in all BlackLight applications to which he had been previously assigned;
- 7) the examination and issuance of all allowable BlackLight applications in accordance with the representations and agreements made at the February 11, 2003 Interview; and
- 8) as a matter of equity, the immediate issuance, without further examination, of all five of BlackLight's withdrawn patent applications due to the PTO's failure to provide the safeguards to the interests of Applicant, including fair and expeditious further examination, as contemplated by the Federal Circuit in its June 28, 2002 Decision.

**Response to Specific Arguments Presented in
the Secret Committee's Most Recent Office Action**

**Preliminary Matters Regarding Form of Applicant's
Response and Information Disclosure Statement,
and Request to Withdrawal Finality of Office Action**

On page 2, paragraph 2 of the pending Office Action, the Committee states that "[i]t appears that the same response filed for 08/467,051 was filed on 3/10/2003 for the present case." This is simply incorrect, as can be verified by a quick comparison of the two documents. Applicant only carried over portions of the response filed in 08/467,051 into the 3/10/2003 response filed in the present case. Applicant notes that the portions carried over still remain unanswered by the PTO to this day, even though the PTO has had two opportunities to respond—in the March 25, 2003 Advisory Action and the pending March 22, 2004 final Office Action.

In this same paragraph, the Committee further states that "[c]laims 1-28 are finally rejected for the reasons of record" without providing any basis for issuing a first action final in this case. This latest Office Action fits the Committee's ongoing pattern of ignoring established patent rules to issue premature final Office Actions. Applicant submits that the present final Office Action is premature, and hereby requests

withdrawal of finality, for the same reasons set forth in Applicant's REQUESTS FOR WITHDRAWAL OF FINALITY UNDER MPEP § 706.07 filed June 21, 2004 in Applicant's copending U.S. App'n. Ser. No. 09/513,768, incorporated herein by reference. To this day, Applicant has not received a response to those Requests.

As in that case, Applicant submitted new experimental evidence with the October 10, 2003 RCE, which the Committee considered for the first time, though superficially, in the present final Office Action. Other responses set forth by the Committee in its final Action could have, and should have, been presented earlier and thus raise new issues. This first Office Action final practice is blatantly unfair and noncompliant with established patent practice.

On page 3, paragraph 3 of the pending Office Action, the Committee states that "[i]t is noted that [IDS] citations that are listed as being submitted, in preparation or in press and without a publication date have been considered but they have been crossed out since these are not yet publications." First of all, it was improper for the Committee to require that Applicant disclose to the world his confidential experimental evidence by submitting it for publication before that evidence would be eligible for consideration. But it is even worse when Applicant complies with that requirement and cites those submitted papers on a PTO-Form 1449 (now PTO/SB/08) and the Committee then refuses to initial the listed citations it has supposedly considered them. Applicant therefore requests that the Committee reconsider its arbitrary decision not to have the Examiner properly initial the PTO-Form 1449.

Rebuttal to Rejections of Applicant's Claims

Applicant reached agreements with the PTO during the February 11, 2003 Interview as to how it would conduct its examination of BlackLight's applications following the tumultuous prosecution history of these cases. The Secret Committee, in its subsequent Office Actions, including the present one, has defaulted on those agreements, whereby examination in this case has reverted back to where Applicant's scientific evidence is almost entirely ignored on baseless theoretical grounds without applying reasonable patent standards, reconfirming that "allowance is not an option."

Despite the unfairness of these actions, Applicant will not be deterred from seeking the patent rights to which he is entitled.

With that said, Applicant now addresses the Committee's most recent arguments presented in the pending Office Action:

Applicant first notes the Committee's initial comment appearing on page 4 that: "Applicant's arguments filed 3/10/2003 and 10/10/2003 have been fully considered but they are not persuasive." As explained below, the Committee has not fully considered those previous arguments, especially those directed to Applicant's experimental evidence supporting the existence of lower-energy hydrogen. To the limited extent that Applicant's evidence has been considered, the Committee's erroneous comments on that evidence, and obvious biases, demonstrate a fatally flawed analysis that once again calls into question its ability to fairly evaluate Applicant's invention in this case.

For instance, the Committee argues on page 4 of the present Office Action:

The invention of the present application is drawn to catalytic reactions of one electron atoms each having an atomic mass of at least four to form compositions of matter comprising new forms of one electron atoms having an atomic mass of at least four and having an increased binding energy greater than the binding energy of the corresponding ordinary atomic ion. Specifically, new forms of one electron atoms such as He^+ , Li^{2+} and Be^{+3} are each disclosed and claimed to have a binding energy greater than the binding energy of ordinary He^+ , ordinary Li^{+2} and ordinary Be^{+3} , respectively.

The only theoretical support for applicant's present invention appears to be related to applicant's theory of the hydrino atom having a binding energy given by $13.6\text{eV}/(1/p)^2$ where p is an integer value greater than 1 (see equation on page 1 of applicant's specification). Applicant postulates that the catalytic reaction of either the conventional ground state hydrogen atom to unconventional lower energy states or the hydrino atom to unconventional lower energy states by reacting an ordinary ground state hydrogen atom or a hydrino atom with a catalyst having a net enthalpy of reaction of about $m \times 27.2 \text{ eV}$ where m is an integer may be generalized to all one electron atoms (see page 4 of applicant's specification). [Bold emphasis added.]

Apparently, the Committee has ignored the enormous body of additional theoretical support Applicant has submitted. Included among the theoretical support

ignored by the Committee is the calculation of hundreds of published spectral lines, energy levels, and other observables in addition to the prediction of the new states of hydrogen as given in the following articles:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", *Physica Scripta*, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", *Progress of Physics*, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", *Physics Essays*, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", *Physics Essays*, in press.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", *Fondation Louis de Broglie*, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", *Physics Essays*, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", *Int. J. Hydrogen Energy*, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

Furthermore, Applicant has provided an enormous body of experimental evidence that lower-energy hydrogen states are produced by the disclosed catalytic reaction, as summarized in the above sections entitled "Lower-Energy Hydrogen Experimental Data" and "Independent Test Results". Applicant must insist that the

Committee properly consider this evidence and allow all claims in this and other pending BlackLight applications.

Because much of Applicant's evidence has been ignored, the Committee's argument that Applicant's theory is merely "postulated" is completely without foundation. The Committee's repeats that unfounded argument on page 5 of the present Office Action, wherein it states:

Applicant defines a one electron atom to be an atom comprising a nucleus and one electron (see page 4 of the specification). Applicant extends his theoretical postulates of the hydrino atom which contains one electron and a nucleus having one proton to all one electron atoms (see pages 4 and 6 of applicant's specification). Applicant merely states in the present specification but does not prove the applicability of theory of the hydrino atom to all one electron atoms. Applicant appears to assume that his theory of the hydrino atom which is postulated and not derived (see reasons below), applies to all one electron atoms by modifying the postulated equation of the energy levels of a hydrino atom which is $13.6 \text{ eV} / (1p)^2$ (see page 1 of the specification) by simply multiplying it with a factor of q^2 where q is the nuclear charge of one electron atom to give the equation $q^2 13.6 \text{ eV} / (1p)^2$ where p is an integer greater than 1 to represent the energy levels of a one electron atom having increased binding energy as compared to the corresponding ordinary one electron atom (see page 10 of applicant's specification). [Emphasis in original.]

Again, Applicant rejects the Committee's assertion that his theory is merely postulated. Rather it is rigorously derived from first principles as pointed out below in response to the Committee's erroneous statements and interpretations. Furthermore, contrary to the Committee's misstatement above, Applicant properly uses the scaling of energy levels with charge according to q^2 in agreement with experimental observations.

On pages 5-6 of the present Office Action, the Committee commits another error in its simplistic analysis of Applicant's theory with respect to the attribution of nuclear charge in his equations:

It does not appear that any of the equations of applicant's theory as shown in applicant's book, the Grand Unified Theory of Classical Quantum Mechanics, either the 1999 edition or the 2000 edition, take into account the nuclear charge q so it is therefore unclear how a solution of the energy levels of a one electron atom involving nuclear charge q would come about from applicant's theory if the nuclear charge q of the atom does not appear in any of the equations. In addition to the increased binding energy

of the one electron atom, applicant asserts that energy is a further product of the catalysis reaction as a result of the lower energy state transitions of the one electron atoms (see page 12 of the specification).

Applicant, however, does disclose the relationship between the energy levels of one-electron atoms and the nuclear charge Z . In fact, Applicant correctly calculates the ionization energies of all one-electron atoms from H to Cu^{28+} . In view of its fatally flawed analysis, the Committee fails to recognize that Applicant's theoretical results agree with the experimental values to the limit that they can be measured as shown in

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.

and Chp One of

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

After describing the so-called "postulated" catalytic reaction of hydrogen to lower energy states, the Committee asserts on page 7 of the present Office Action:

It appears that applicant extends his model of the hydrino atom by assuming without an explanation that all one electron atoms will undergo lower energy state transitions in the presence of a catalyst that provides a net enthalpy of reaction of about $m \times 27.2$ eV where m is an integer. Applicant asserts on page 5 of the specification that a hydrino atom may provide a net enthalpy of reaction of about $m \times 27.2$ eV where m is an integer in an ionization reaction to served as a catalyst for He^+ (which is a one electron atom) or lower-energy He^+ to undergo a transition to a lower energy state (see page 5 of applicant's specification). [Emphasis added.]

These misplaced assertions show a complete lack of familiarity with Applicant's submitted evidence including Chp. One of

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

which shows that the energy levels of one-electron atoms scale with charge according to Z^2 in agreement with experimental observations.

Additional errors in the Committee's analysis of Applicant's disclosed invention appear on page 7 of the present Office Action, which demonstrate an amazing lack of understanding of basic scientific principles regarding energy transfer:

There is no plausible physical mechanism of energy transfer to explain why a catalyst having a net enthalpy of reaction of $m \times 27.2$ eV would cause a lower energy state transition of a one electron atom such as hydrogen from the ordinary ground state $n = 1$ to a lower nonexistent energy state $n = _$. Moreover, the net enthalpy of reaction of $m \times 27.2$ eV does not match the energy given off by the first lower energy state transition of $n = 1$ to $n = 1/2$ which is 40.8 eV as admitted by applicant on page 4 of applicant's specification. [Emphasis in original.]

Contrary to the Committee's misstatement, there are such physical mechanisms of energy transfer that are quite well known to those having ordinary skill in the art. These mechanisms are exemplified by the radiationless formation of chemical bonds and the mechanism of phosphors in fluorescent lighting as given in Chps 5 and 6 of

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

Again, had the Committee taken the time to fully familiarize itself with these aspects of Applicant's invention, it would not be prone to making such fundamental errors in its analysis.

Furthermore, there is a nonradiative energy transfer of $m \times 27.2$ eV to increase the electric interaction strength between the electron and the central field. Then, the remaining energy between the initial and final states is given off as the radius decreases

to the final radius. The energy released in this second step can be observed spectroscopically, or it can be conserved by the formation of fast hydrogen atoms. Both are observed as shown in

105. J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.
67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.
33. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.
37. R. L. Mills, P. Ray, B. Dhandapani, R. M. Mayo, J. He, "Comparison of Excessive Balmer α Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts", J. of Applied Physics, Vol. 92, No. 12, (2002), pp. 7008-7022.
49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355.

The Committee once again demonstrates its unfamiliarity with Applicant's disclosed invention on page 7 of the present Office Action by its assertion of a supposed contradiction in Applicant's theory:

Applicant also appears to contradict himself regarding the net enthalpy of reaction of the catalyst on page 11 of the specification. Applicant states on page 11 of the specification that the method comprises reacting one electron atoms with catalyst having a net enthalpy of reaction of about $m/2 \times 27$ eV where m is an integer greater than 1 in contrast to page 4 of the specification which states that a one electron atom is catalyzed to a lower energy state when it is reacted with a catalyst having a net enthalpy of reaction of about $m \times 27.2$ eV where m is an integer. Applicant also states on pages 13 and 18 of the specification that the catalytic reaction for producing the hydrino atom provides a net enthalpy of reaction of about $m/2 \times 27$ eV in direct contrast to page 2 of the specification which states that hydrino atoms are formed by reacting an

ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about $m \times 27.2$ eV. [Emphasis in original.]

No such contradiction exists. Hydrinos are formed by reacting an ordinary hydrogen atom with a catalyst having a net enthalpy of reaction of about

$$m \cdot 27.2 \text{ eV} \quad (2a)$$

where m is an integer. This catalyst has also been referred to as an energy hole or source of energy hole in Mills earlier filed Patent Applications. It is believed that the rate of catalysis is increased as the net enthalpy of reaction is more closely matched to $m \cdot 27.2$ eV. It has been found that catalysts having a net enthalpy of reaction within $\pm 10\%$, preferably $\pm 5\%$, of $m \cdot 27.2$ eV are suitable for most applications.

In another embodiment, the catalyst to form hydrinos has a net enthalpy of reaction of about

$$m/2 \cdot 27.2 \text{ eV} \quad (2b)$$

where m is an integer greater than one. It is believed that the rate of catalysis is increased as the net enthalpy of reaction is more closely matched to $m/2 \cdot 27.2$ eV. It has been found that catalysts having a net enthalpy of reaction within $\pm 10\%$, preferably $\pm 5\%$, of $m/2 \cdot 27.2$ eV are suitable for most applications.

The ionization energy of hydrogen is 13.6 eV. Two atoms can provide a net enthalpy of a multiple of that of the potential energy of the hydrogen atom for the third hydrogen atom. The ionization energy of two hydrogen atoms is 27.21 eV, which is equivalent to $m = 1$ in Eq. (2). Thus, the transition cascade for the p th cycle of the hydrogen-type atom, $H\left[\frac{a_H}{p}\right]$, with two hydrogen atoms, $H\left[\frac{a_H}{1}\right]$, as the catalyst that causes the transition reaction is represented by

$$27.21 \text{ eV} + 2H\left[\frac{a_H}{1}\right] + H\left[\frac{a_H}{p}\right] \rightarrow 2H^+ + 2e^- + H\left[\frac{a_H}{(p+1)}\right] + [(p+1)^2 - p^2] \times 13.6 \text{ eV} \quad (24)$$

$$2H^+ + 2e^- \rightarrow 2H\left[\frac{a_H}{1}\right] + 27.21 \text{ eV} \quad (25)$$

And, the overall reaction is

$$H\left[\frac{a_H}{p}\right] \rightarrow H\left[\frac{a_H}{(p+1)}\right] + [(p+1)^2 - p^2] \times 13.6 \text{ eV} \quad (26)$$

The $m/2 \times 27 \text{ eV}$ case further includes catalysts such as neon ion wherein resonant nonradiative energy transfer involves the entire energy difference between the initial and final states. The catalysis of $H(1)$ to $H(1/2)$ releases 40.8 eV , and the second ionization energy of neon is 40.96328 . Ne^+ may absorb about 40.8 eV and ionize to Ne^{2+} which is resonant with the difference in energy between the $p = 2$ and the $p = 1$ states of atomic hydrogen given by:

$$E_n = -\frac{e^2}{n^2 8\pi\epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2}$$

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer}$$

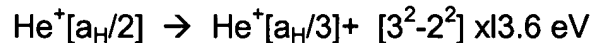
Thus, Ne^+ may serve as also a catalyst to cause the transition between these hydrogen states.

A catalyst of the present invention may provide a net enthalpy of $m \cdot 27.2 \text{ eV}$ where m is an integer or $m/2 \cdot 27.2 \text{ eV}$ where m is an integer greater than one by undergoing a transition to a resonant excited state energy level with the energy transfer from hydrogen. For example, He^+ absorbs 40.8 eV during the transition from the $n = 1$ energy level to the $n = 2$ energy level which corresponds to $3/2 \cdot 27.2 \text{ eV}$ ($m = 3$ in Eq. (2b)). This energy is resonant which the difference in energy between the $p = 2$ and the $p = 1$ states of atomic hydrogen given by Eq. (1). Thus He^+ may serve as a catalyst to cause the transition between these hydrogen states.

A catalyst of the present invention may provide a net enthalpy of $m \cdot 27.2 \text{ eV}$ where m is an integer or $m/2 \cdot 27.2 \text{ eV}$ where m is an integer greater than one by becoming ionized during resonant energy transfer. For example, the third ionization energy of argon is 40.74 eV ; thus, Ar^{2+} absorbs 40.8 eV during the ionization to Ar^{3+} which corresponds to $3/2 \cdot 27.2 \text{ eV}$ ($m = 3$ in Eq. (2b)). This energy is resonant which the difference in energy between the $p = 2$ and the $p = 1$ states of atomic hydrogen given by Eq. (1). Thus Ar^{2+} may serve as a catalyst to cause the transition between these hydrogen states.

The Committee's argument on page 8 of the present Office Action demonstrates yet another basic misunderstanding of Applicant's invention, casting doubt on the accuracy of its entire analysis:

On page 13 of the specification, applicant proposes a mechanism of catalyzing ordinary He^+ atom with Fe to give an overall reaction of



This mechanism does not appear to make any sense since it does not show how $\text{He}^+[\text{a}_\text{H}/2]$ corresponding to $p=2$ state for He^+ is initially obtained since the reaction starts out with ordinary He^+ ($p=1$) and Fe. It would appear from the analogous reaction equation for the hydrino atom on page 3 of applicant's specification that the equation on page 13 of the specification corresponds to a transition of $p=2$ of He^+ to $p=3$ of He^+ .

In response, Applicant can only point out that the initial state of He^+ has a radius of $\text{a}_\text{H}/2$ as shown in basic physic textbooks on atomic theory, including quantum mechanical textbooks. See, for example, D. A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, CA, (1983), p. 29. Again, Applicant has serious concerns over Committee comments that demonstrate an unfamiliarity with what was thought to be a basic scientific fact.

These concerns are only heightened by the further comments on pages 8-9 of the present Office Action that:

In addition, the enthalpy part of the equation on page 13 is off by a factor of 4 since the nuclear charge for helium is $q=2$ and must be accounted for in the binding energy of a one electron helium ion according to applicant's theory as seen in equation 11 on page 10 of applicant's specification. The energy difference between the $\text{He}^+[\text{a}_\text{H}/3]$ state and the $\text{He}^+[\text{a}_\text{H}/2]$ state is 272 eV according to equation 11 on page 10 of applicant's specification and the triple ionization reaction of Fe to Fe^{3+} having a net enthalpy of reaction of 54.7 eV would not be able to catalyze the reaction as asserted by applicant on page 13 of the specification. Therefore, applicant's mechanism on page 13 for catalyzing He^+ using Fe to a lower energy state is not plausible and does not make any physical or mathematical sense.

The Committee, however, fails to recognize that the parameter p for Eq. (11) and that for Eqs. (11-14) are different. As defined, the equation for the catalysis of He^+ by Fe is correct. As disclosed on p. 13, the binding energies of atoms with radii $r = \frac{a_H}{p}$ are

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{\left(\frac{1}{p}\right)^2} \quad (1)$$

as shown by

$$\text{He}^+ \left[\frac{a_H}{2} \right] \rightarrow \text{He}^+ \left[\frac{a_H}{3} \right] + [3^2 - 2^2] 13.6 \text{ eV} \quad (14)$$

For example, the radius of hydrogen is a_H and the energy is 13.6 eV. The radius for helium is $a_H/2$ and the energy is 54.4 eV.

The text given immediately before Eqs. (11-14) identifies the appropriate energy relationship as Eq. (1):

Catalysts

A catalyst of the present invention of a novel catalytic reaction to produce increased binding energy one electron atoms is a hydrino atom having a binding energy given by Eq. (1) which provides a net enthalpy of reaction of about $\frac{m}{2} \cdot 27 \text{ eV}$, where m is an integer greater than 1, preferably an integer less than 400.

In the embodiment of Eq. (11), $p=2$ refers to a state with one-half the radius of helium or a radius of $a_H/4$ which correctly corresponds to a binding energy of $p^2 X q^2 = 2^2 X 2^2 = 16 X 13.6 \text{ eV} = 4^2 X 13.6 \text{ eV}$.

The Committee, on page 9 of the present Office Action, continues its misunderstanding of the mechanism for catalyzing He^+ to a lower energy state:

Moreover, applicant has not shown how this incorrect mechanism would even be applicable to all one-electron atoms since the nuclear charge q would be different for different atoms and would affect applicant's proposed catalytic net enthalpy requirements of reaction according to equation 11 on page 10 of applicant's specification.

The energy equation for Eqs. (11-14) is correctly given as

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{\left(\frac{1}{p}\right)^2} \quad (1)$$

as shown by

$$\text{He}^+ \left[\frac{a_H}{2} \right] \rightarrow \text{He}^+ \left[\frac{a_H}{3} \right] + [3^2 - 2^2] \times 13.6 \text{ eV} \quad (14)$$

and by the disclosure of Eq. (1) with respect to these reactions.

In view of these and other errors described herein, Applicant respectfully requests that the Committee withdraw its rejections and immediately allow all of the pending claims in this case.

In yet another example of its failed analysis, the Committee presents the following arguments on page 9 of the present Office Action that merely support Applicant's call for allowance in this case:

Notwithstanding the implausibility of the mechanism of catalysis proposed by applicant as discussed above and the inconsistencies in the present specification of the net enthalpy requirements of the catalytic reaction of a one electron atom to form an increased binding energy one electron atom as compared to the binding energy of a corresponding ordinary one electron atom ($m/2 \times 27.2 \text{ eV}$ vs. $m \times 27 \text{ eV}$), energy states lower than $n = 1$ for a one electron atom, whether they are those of a hydrino atom, or those of a one electron atom having an atomic mass of at least four, are not conventionally known or accepted by one of ordinary skill in the art. [Emphasis in original.]

The fact, however, that the lower energy states for a one electron atom are not commonly known is not a reason to reject the present application, but a reason to allow it, as it speaks to the complete absence of relevant prior art. Applicant has shown the existence of lower energy states of hydrogen by overwhelming evidence. As shown and supported by the 107 papers listed in the above section entitled "Lower-Energy Hydrogen Experimental Data," a chemically generated or assisted plasma source has been developed [1-107]. The theory given previously is based on applying Maxwell's equations to the Schrödinger equation as the basis of a theory of classical quantum

mechanics (CQM) [5, 17, 21-22, 53, 58, 80, 94, 102, 106-107]. A natural relationship arises between Maxwell's equations, special relativity, and general relativity such that CQM holds over a scale of spacetime of 85 orders of magnitude—it correctly predicts the nature of the universe from the scale of the quarks to that of the cosmos.

The familiar Rydberg equation (Eq. (1)) arises for the hydrogen excited states for $n > 1$ of Eq. (2).

$$E_n = -\frac{e^2}{n^2 8\pi\epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (1)$$

$$n = 1, 2, 3, \dots \quad (2)$$

An additional result is that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer} \quad (3)$$

replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. The $n = 1$ state of hydrogen and the $n = \frac{1}{\text{integer}}$ states of hydrogen are nonradiative, but a transition between two nonradiative states, say $n = 1$ to $n = 1/2$, is possible via a nonradiative energy transfer. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \text{ eV}$ (i.e. it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (1) and (3). Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling.

Studies that experimentally confirm a novel reaction of atomic hydrogen which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state, a chemically generated or assisted plasma (rt-plasma), and produces novel hydride compounds include extreme ultraviolet (EUV) spectroscopy [11-16, 20, 24, 27-29, 31-36, 39, 42-43, 46-47, 50-52, 54-55, 57, 59, 63, 65-68, 70-76, 78-79, 81, 83, 85, 86, 89, 91-93, 95-96, 98, 101, 104], characteristic emission from catalysis and the hydride ion products [24, 27, 32, 39, 42, 46, 51-52, 55, 57, 68, 72-73, 81, 89, 91], lower-energy hydrogen emission [14, 28-29, 33-36, 50, 63, 67, 70-71, 73, 75-76, 78-79, 86-87, 90, 92, 93, 98, 101, 104], plasma formation [11-13, 15-16, 20, 24, 27, 32, 39, 42, 46-47, 51-52, 54-55, 57, 72, 81, 89, 91-93], Balmer α line broadening [16, 20, 30, 33-37, 39, 42-43, 49, 51-52, 54-55, 57, 63-65, 68-69, 71-74, 81-85, 88-89, 91, 92, 93, 95-97, 105], population inversion of hydrogen lines [39, 46, 51, 54, 55, 57, 59, 65-66, 68, 74, 83, 85, 89, 91], elevated electron temperature [34-37, 43, 49, 63, 67, 73], anomalous plasma afterglow duration [12-13, 47, 81], power generation [30-31, 33, 35-36, 39, 43, 50, 63, 71-73, 76-77, 81, 84, 89, 92, 93, 98, 101, 104], excessive light emission [11, 16, 20, 23, 31, 37, 43, 52, 72], and analysis of chemical compounds [6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104]. Direct plasma to electric power conversion is possible [18, 26, 40, 48, 56, 68].

The Committee's obvious lack of familiarity with this overwhelming scientific evidence is disconcerting to Applicant and for good reason.

Adding to Applicant's discomfort level are the Committee arguments appearing on pages 9-10 of the present Office Action:

Since applicant's present invention for one electron atoms having increased binding energy is based on an unexplained extension of applicant's erroneous theory of the hydrino atom by simply multiplying the energy levels of a hydrino atom by q^2 where q is the nuclear charge of the one electron atom, applicant's presently claimed invention of compounds and method of making these compounds comprising one electron atoms having an increased binding energy greater than the binding energy of the corresponding ordinary atomic ion are not theoretically supported since the theory of the hydrino atom is mathematically and scientifically flawed for reasons given below.

As discussed below, Applicant's theory of the hydrino atom is not flawed as asserted by the Committee. Rather, Applicant's theory, which is an application of Maxwell's equations to the atom, is correct and confirmed by real-world data, whereas, the truly postulated, nonphysical theory of quantum mechanics is fatally flawed. The extension of the theory to additional one-electron atoms is natural and physical.

The existence of hydrino and compounds containing hydrino have been confirmed experimentally as shown in articles 6-10, 19, 25, 38, 41, 44-45, 60-62, 64, 69, 75, 81-82, 87-88, 90, 92, 93, 94, 98, 100, 101, 104.

On page 10 of the present Office Action, the Committee argues:

Furthermore, applicant has not provided independent experimental evidence for these new forms of one electron atoms having an atomic mass of at least four and having an increased binding energy greater than the binding energy of the corresponding ordinary one electron atomic ion. All experimental submissions to date are drawn to applicant's attempt to prove the existence of the hydrino atom based on experiments containing a hydrogen atom and therefore do not provide experimental evidence for new forms of one electron atoms having an atomic mass of at least four and having an increased binding energy greater than the binding energy of the corresponding ordinary one electron atomic ion. Nevertheless, applicant's experimental submissions to prove the existence of the hydrino atom are not persuasive for reasons given below.

The Committee's view of the evidence, however, is far too constrained. Applicant's data substantially proves the existence of states given by the equation

$$\text{Binding Energy} = \frac{13.6 \text{ eV}}{\left(\frac{1}{p}\right)^2} \quad (1)$$

which supports the existence of such states in other one-electron atoms.

In contrast, the Committee, on page 10 of the present Office Action, gives quantum mechanics far too much credit given its well recognized failures:

From applicant's arguments of record it is evident that he rejects a century of work in quantum mechanics by those of skill in the art such as Nobel Laureates Schrodinger, Dirac, and Feynman as discussed in the ATTACHMENT TO RESPONSE TO APPLICANT'S ARGUMENTS attached to paper #12 mailed on 3/25/2003 (hereinafter referred to as "ATTACHMENT in paper #12") in favor of his own theory of the hydrogen

atom that allegedly predicts a new form of the hydrogen atom known as the hydrino atom. However, applicant's theory of the hydrino atom fails to be a scientifically credible alternative in place of the conventionally established theory of quantum mechanics for the hydrogen atom for reasons given in the ATTACHMENT in paper #12. [Emphasis in original.]

It is hypocritical for the Committee to dismiss out of hand Applicant's well-supported theory while it proclaims that all the work of theoretical physics is finished, when quantum mechanics has not completely and internally consistently solved even a single problem. That quantum mechanics can not internally consistently solve any problem with conjugate observables is shown in:

- 107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physica Scripta, submitted.
- 106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Progress of Physics, submitted.

Furthermore, Schrodinger, Dirac, Feynman, and other founders of quantum mechanics had serious reservations regarding quantum mechanics as discussed in

- 107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physica Scripta, submitted.
- 106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Progress of Physics, submitted.
- 102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.
- 94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.
- 80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Fondation Louis de Broglie, submitted.
- 1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

The Committee's failure to recognize these serious reservations is telling. Ironically, Dirac originally attempted to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gave rise to electron spin [P. Pearle, *Foundations of Physics*, "Absence of radiationless motions of relativistically rigid classical electron", Vol. 7, Nos. 11/12, (1977), pp. 931-945] as discussed in

- 107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", *Physica Scripta*, submitted.
- 80. R. L. Mills, *The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics*, Fondation Louis de Broglie, submitted.

He was unsuccessful and resorted to the current mathematical-probability-wave model that has many problems. [See R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183; R. Mills, *The Nature of Free Electrons in Superfluid Helium—a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory*, *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096; R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; July 2003 Edition posted at <http://www.blacklightpower.com/bookdownload.shtml>, Foreword and Chp 37.]

The unsuccessful approach attempted by Dirac and other founders of quantum mechanics is the very approach used, now successfully, by Applicant. Maxwell's equations are physical laws that can be directly proven, as opposed to the purely postulated mathematics of quantum mechanics. The Maxwellian approach used as a basis by Applicant's theory permits the determination of the stability of the hydrogen atom; whereas, quantum mechanics does not, as shown in:

- 80. R. L. Mills, *The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics*, Fondation Louis de Broglie, submitted.

Applicant has further shown that CQM is superior to SQM (standard quantum mechanics). For example, SQM has never solved a physical problem and has never solved conjugate parameters using the wave equation solution from one problem to

solve any other. In contrast, the solutions from CQM are shown to be internally consistent and based on physical laws for hundreds of observables, such as over 100 excited states of helium, the solution of over 400 atoms and ions, and the scattering of electrons from helium. These unprecedented CQM achievements, compared to the failings of SQM, are given in:

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Progress of Physics, submitted:

Abstract

Quantum mechanics (QM) and quantum electrodynamics (QED) are often touted as the most successful theories ever. In this paper, this claim is critically evaluated by a test of internal consistency for the ability to calculate the conjugate observables of the nature of the free electron, ionization energy, elastic electron scattering, and the excited states of the helium atom using the same solution for each of the separate experimental measurements. It is found that in some cases quantum gives good numbers, but the solutions are meaningless numbers since each has no relationship to providing an accurate physical model. Rather, the goal is to mathematically reproduce an experimental or prior theoretical number using adjustable parameters including arbitrary wave functions in computer algorithms with precision that is often much greater (e.g. 8 significant figures greater) than possible based on the propagation of errors in the measured fundamental constants implicit in the physical problem. Given the constraints of adherence to physical laws and internal consistency, an extensive literature search indicates that quantum mechanics has never solved a single physical problem correctly including the hydrogen atom and the next member of the periodic chart, the helium atom. Rather than using postulated unverifiable theories that treat atomic particles as if they were not real, physical laws are now applied to the same problem. In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of e^- moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach is explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level. The proverbial view deeply seated in the wave-particle duality notion that there is no large-scale physical counterpart to the nature of the electron is shown not to be correct. Physical laws and intuition may be restored when dealing with the wave equation and quantum atomic problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles as reported previously [1-6] that successfully applies physical laws to the solution of atomic problems that has its basis in a breakthrough in the understanding of the stability of the bound electron to radiation. Rather than using the postulated Schrödinger boundary condition: " $\Psi \rightarrow 0$ as $r \rightarrow \infty$ ", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation.

Using Maxwell's equations, *the classical wave equation is solved with the constraint that the bound $n = 1$ -state electron cannot radiate energy.* Although it is well known that an accelerated *point* particle radiates, an *extended distribution* modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. The accurate solution of the helium atom is confirmed by the agreement of predicted and observed conjugate parameters using the same unique physical model in all cases.

Further, CQM gives extraordinary results that are better than those of QED without the fictitious "virtual particles" that render QED more fiction than science as discussed in:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physica Scripta, submitted:

Abstract

The claim that quantum electrodynamics (QED) is the most successful theory in history is critically evaluated. The Dirac equation was postulated in 1926 as a means to remedy the nonrelativistic nature of the Schrödinger equation to provide the missed fourth quantum number. The positive as well as negative square root terms provided an argument for the existence of negative energy states of the vacuum, virtual particles, and corresponding so-called quantum electrodynamics (QED) computer algorithms for calculating unexpected observables such as the Lamb shift and the anomalous magnetic moment of the electron. It is true that it is possible to calculate to a high degree of precision the very small correction to the classical magnetic moment of a point-particle electron using QED, but it is at the expense of any reasonable or verifiable physics. The method relies on a string of far-fetched and unverifiable or disproved assumptions such as (1) infinite electric and magnetic fields that are arbitrarily normalized, (2) a "zoo" of infinite numbers of virtual particles at every point in space, (3) polarization of the vacuum by the proposed virtual particles, (4) postulated participation of the members of the zoo in myriad schemes to cause the so-called polarization, (5) the contribution from each such scheme corresponds to a coefficient based on the product of ratio of the mass of the virtual particle to that of the real particle being experimentally observed and , and (6) the schemes can be arbitrarily truncated to avoid further infinities. Due to the lack of rigor and a physical basis, QED calculations are argued to be meaningless. In a broader sense, the connection between the underlying

quantum mechanics and reality is more than just a "philosophical" issue. It reveals that quantum mechanics is not a correct or complete theory of the physical world and that inescapable internal inconsistencies and incongruities arise when attempts are made to treat it as a physical as opposed to a purely mathematical "tool". Some of these issues are discussed in a review by Laloë [1]. Moreover, Dirac's original attempt to solve the bound electron physically with stability with respect to radiation according to Maxwell's equations with the further constraints that it was relativistically invariant and gives rise to electron spin is achievable using a classical approach. Starting with the same essential physics as Bohr, Schrödinger, and Dirac of moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, advancements in the understanding of the stability of the bound electron to radiation is applied to solve for the exact nature of the electron. Rather than using the postulated Schrödinger boundary condition: " ψ " as " ψ ", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, the classical wave equation is solved with the constraint that the bound ψ -state electron cannot radiate energy. Although it is well known that an accelerated point particle radiates, an extended distribution modeled as a superposition of accelerating charges does not have to radiate. A simple invariant physical model arises naturally wherein the predicted results are extremely straightforward and internally consistent requiring minimal math as in the case of the most famous equations of Newton, Maxwell, Einstein, de Broglie, and Planck on which the model is based. No new physics is needed; only the known physical laws based on direct observation are used. Rather than invoking untestable "flights of fantasy", the results of QED such as the anomalous magnetic moment of the electron, the Lamb Shift, the fine structure and hyperfine structure of the hydrogen atom, and the hyperfine structure intervals of positronium and muonium can be solved exactly from Maxwell's equations to the limit possible based on experimental measurements which confirms QED's illegitimacy as representative of reality.

The solution of the 26 experimentally measured parameters of hydrogen molecules and molecular ions from a closed-form derivation is a further unmatched achievement of CQM in solving conjugate observables consistently as given in

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, in press.

To cite another example of the triumph of CQM over SQM, Applicant has solved over 400 atoms and ions in exact closed-form equations containing the integer nuclear charge only:

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted:

ABSTRACT

It is true that the Schrödinger equation can be solved exactly for the hydrogen atom; although, it is not true that the result is the exact solution of the hydrogen atom. Electron spin is missed entirely, and there are many internal inconsistencies and nonphysical consequences that do not agree with experimental results. The Dirac equation does not reconcile this situation. Many additional shortcomings arise such as instability to radiation, negative kinetic energy states, intractable infinities, virtual particles at every point in space, the Klein paradox, violation of Einstein causality, and "spooky" action at a distance. Despite its successes, quantum mechanics (QM) has remained mysterious to all who have encountered it. Starting with Bohr and progressing into the present, the departure from intuitive, physical reality has widened. The connection between quantum mechanics and reality is more than just a "philosophical" issue. It reveals that quantum mechanics is not a correct or complete theory of the physical world and that inescapable internal inconsistencies and incongruities arise when attempts are made to treat it as a physical as opposed to a purely mathematical "tool". Some of these issues are discussed in a review by Laloë [1]. But, QM has severe limitations even as a tool. Beyond one-electron atoms, multielectron-atom quantum mechanical equations can not be solved except by approximation methods involving adjustable-parameter theories (perturbation theory, variational methods, self-consistent field method, multi-configuration Hartree Fock method, multi-configuration parametric potential method, expansion method, multi-configuration Dirac-Fock method, electron correlation terms, QED terms, etc.)—all of which contain assumptions that can not be physically tested and are not consistent with physical laws. In an attempt to provide some physical insight into atomic problems and starting with the same essential physics as Bohr of moving in the Coulombic field of the proton and the wave equation as modified after Schrödinger, a classical approach was explored which yields a model which is remarkably accurate and provides insight into physics on the atomic level [2-4]. Physical laws and intuition are restored when dealing with the wave equation and quantum mechanical problems. Specifically, a theory of classical quantum mechanics (CQM) was derived from first principles that successfully applies physical laws on all scales. Rather than use the postulated Schrödinger boundary condition: " ψ as $r \rightarrow \infty$ ", which leads to a purely mathematical model of the electron, the constraint is based on experimental observation. Using Maxwell's equations, the classical wave equation is solved with the constraint that the bound $-state$ electron cannot radiate energy. The electron must be extended rather than a point. On this basis with the assumption that physical laws including Maxwell's equation apply to bound electrons, the hydrogen atom was solved exactly from first principles. The remarkable agreement across the spectrum of experimental results indicates that this is the correct model of the hydrogen atom. In this paper, the physical approach was applied to multielectron atoms that were solved exactly disproving the deep-

seated view that such exact solutions can not exist according to quantum mechanics. The general solutions for one through twenty-electron atoms are given. The predictions are in remarkable agreement with the experimental values known for 400 atoms and ions.

These results can not be matched by SQM. The probability that CQM can calculate 100's of observables in exact equations containing fundamental constants only based on laws of nature and not be the correct theory of nature is essentially zero. In contrast, SQM is easily shown to be fatally flawed as discussed previously in:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", *Physica Scripta*, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", *Progress of Physics*, submitted.

102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", *Physics Essays*, submitted.

94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", *Physics Essays*, submitted.

80. R. L. Mills, *The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics*, Fondation Louis de Broglie, submitted.

58. R. L. Mills, "Classical Quantum Mechanics", *Physics Essays*, in press.

21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", *Int. J. Hydrogen Energy*, Vol. 27, No. 5, (2002), pp. 565-590.

17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096.

5. R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey,

Distributed by Amazon.com; January 2004 Edition posted at
www.blacklightpower.com.

Despite Applicant's demonstration that his theory predicting lower energy states of hydrogen is based on compliance with all physical laws, the Committee continues to erroneously argue that the hydrino atom violates "known laws" on page 11 of the present Office Action:

The existence of the hydrino atom is contrary to the known laws and theories of chemistry and physics. Applicant's theory of the hydrino atom predicts a new form of the hydrogen atom having energy states represented by fractional quantum numbers that are below the conventional ground state of the hydrogen atom. These energy states having fractional quantum numbers are contrary to the conventionally accepted energy states of the hydrogen atom having positive integer quantum numbers predicted by quantum mechanics that have been successfully verified by decades of independent, reproducible experimental results as stated in ATTACHMENT in paper #12. [Emphasis in original.]

Applicant notes, once again, that the Committee fails to identify a single law that has been violated by the practice of Applicants invention. The Committee's alternative assertion that known theories do not predict the existence of the hydrino atom merely recognizes the novelty of Applicant's invention and, thus, argues in favor of allowance, not rejection, of the present application.

The operability of Applicant's invention is now supported by the 58 peer reviewed publications, the 49 papers in review, and the 51 independent validation reports summarized in the attached documents. As discussed above, Applicant's theory gives superior results to those of quantum mechanics.

To put it in simpler terms, quantum theory can be compared to a showing that $2=2$. It involves a wave equation with an infinite number of solutions. Only those solutions which match previous data are accepted, and the other infinite number of solutions are rejected as not having been observed to date. That does not theoretically preclude the existence of other states, since quantum mechanics gives no physical basis for the existence of the known Rydberg states. Rather it gives a circular

argument. The infinite number of additional states as solutions to the Schrodinger equation (not just the ones given in textbooks) is given in Margenau and Murphy [H. Margenau, G. M. Murphy, The Mathematics of Chemistry and Physics, D. Van Nostrand Company, Inc., New York, (1943), pp. 77-78] and Ref. [17] (R. L. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096).

The Committee, on page 11 of the present Office Action, continues to turn a "blind eye" towards Applicant's real-world data confirming the existence of lower-energy hydrogen, while extolling the false virtues of quantum mechanics by arguing:

As deduced from the experimentally observed spectrum of the H atom, it is well-established that it has a ground state energy level ($n=1$) as well as excited energy states corresponding to integer values of $n>1$. There is no experimental evidence besides applicant's own interpretation of his data, that there are allegedly novel energy states corresponding to non-integer or fractional values of n for the hydrogen atom. Moreover, the spectrum of the H atom is accurately predicted by the well-known modern theory of quantum mechanics based on Schrödinger's equation and refinements thereof such as Dirac's equation as discussed in the ATTACHMENT in paper #12. [Emphasis in original.]

As discussed in detail above, quantum mechanics does not predict the states of hydrogen. It is mathematically fitted to the states since it is not a physical theory. Rather, it is purely postulated mathematics that can not be directly tested and gives rise to many nonsensical results. There are many internal inconsistencies and nonphysical consequences that do not agree with experimental results. The Dirac equation does not reconcile this situation. Many additional shortcomings arise, such as instability to radiation, negative kinetic energy states, intractable infinities, virtual particles at every point in space, the Klein paradox, violation of Einstein causality, and "spooky" action at a distance. These issues were discussed previously in

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", Physica Scripta, submitted.

106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", Progress of Physics, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", Physics Essays, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", Physics Essays, submitted.
80. R. L. Mills, The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics, Fondation Louis de Broglie, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", Physics Essays, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

Furthermore, Applicant has submitted 51 independent papers and reports that confirm the existence of lower-energy hydrogen, as summarized in the above section entitled "Independent Test Results." The Committee's continued refusal to give this real-world scientific evidence proper consideration based on misguided theoretical musings only serves to further undercut its own arguments.

Yet other example of how the Committee's misplaced theoretical arguments have blinded it from fairly evaluating Applicant's submitted evidence appears on pages 11-12 of the present Office Action:

There is no established modern theory of science that predicts energy levels of the hydrogen atom that would fall below the ground state energy of the hydrogen atom having fractional quantum numbers as postulated by applicant's theory. Indeed, scientists have continued to refine quantum mechanics to apply it to vastly more complex entities than the H atom and it is agreed amongst those of skill in the art that the properties of the hydrogen atom to date have been fully characterized to an extraordinarily high degree of accuracy as discussed in the ATTACHMENT in paper #12.

* * *

Applicant also states that documents submitted of record show experimental support for applicant's fractional quantum number states of the hydrogen atom (a hydrogen atom existing in one of these fractional quantum number states is called a hydrino) that are hitherto unknown to one of ordinary skill in the art. It is noted that the experimental data submitted are largely applicant's own work which have not been conventionally accepted by those of ordinary skill in the art. In response, the ATTACHMENT in paper #12 has already provided substantial evidence that the hydrino atom does not theoretically or physically exist as presently claimed and thus those skilled in the art would "reasonably doubt" the asserted utility and operability of applicant's invention (see ATTACHMENT in paper #12).

Applicant again refers the Committee to the many failings of quantum mechanics and the merits of his experimental evidence discussed above in much detail. The Committee's lack of familiarity with Applicant's evidence is apparent by its comment that the "experimental data submitted are largely applicant's own work," without recognition that much of that data was in fact independently generated by third parties in accordance with PTO patentability requirements newly created for this one Applicant. This third-party data can be found throughout the 58 peer-reviewed publications, the 49 papers submitted for publication, and the 51 independent validation reports summarized in the attached documents that support the operability of Applicant's invention.

Further, Applicant has provided nine theoretical papers and a book of over 1000 pages:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", *Physica Scripta*, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", *Progress of Physics*, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", *Physics Essays*, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", *Physics Essays*, in press.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", *Fondation Louis de Broglie*, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", *Physics Essays*, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", *Int. J. Hydrogen Energy*, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

Below is a partial list of observables that are solved by CQM in a superior manner over quantum mechanics without any adjustable parameters as used in SQM, wherein quantum mechanics has been shown, in many instances, to have no applicability and to be an absolute failure after decades of futile attempts:

Table 1. Partial List of Physical Phenomena Solved by CQM.

<ul style="list-style-type: none"> • Stability of the atom to radiation • Magnetic moment of a Bohr magneton and relativistic invariance of each of $\frac{e}{m_e}$ of the electron, the electron angular momentum of \hbar, and the electron magnetic moment of μ_B from the spin angular momentum • Stern Gerlach experiment • Electron and muon g factors • Rotational energies and momenta • Reduced electron mass • Ionization energies of one-electron atoms • Special relativistic effects • Excited states • Resonant line width and shape • Selection rules • Correspondence principle • Orbital and spin splitting • Stark effect • Lamb Shift • Knight shift • Spin-orbital coupling (fine structure) • Spin-nuclear coupling (hyperfine structure) • Hyperfine structure interval of muonium • Nature of the free electron • Nature of the photon • Photoelectric effect 	<ul style="list-style-type: none"> • Compton effect • Wave-particle duality • Double-slit experiment for photons and electrons • Davisson Germer experiment • Elastic electron scattering from helium atoms • Ionization energies of multielectron atoms • Hydride ion binding energy and absolute NMR shift • Excited states of the helium atom • Proton scattering from atomic hydrogen • Nature of the chemical bond • Bond energies, vibrational energies, rotational energies, and bond distances of hydrogen-type molecules and molecular ions, absolute NMR shift of H_2 • Superconductivity and Josephson junction experiments • Integral and fractional quantum Hall effects • Aharonov-Bohm effect • Aspect experiment • Durr experiment on the Heisenberg Uncertainty Principle • Penning trap experiments on single ions • Hyperfine structure interval of positronium • Magnetic moments of the nucleons • Beta decay energy of the neutron • Binding energy of deuterium • Alpha decay
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Table 2. Partial List of Particle and Cosmological Phenomena Solved by CQM.

<ul style="list-style-type: none"> • Deflection of light by stars • Precession of the perihelion of Mercury • Lepton masses • Quark masses • Hubble constant • Age of the universe • Observed acceleration of the expansion • Power of the universe 	<ul style="list-style-type: none"> • Power spectrum of the universe • Microwave background temperature • Uniformity of the microwave background radiation • Microkelvin spatial variation of the microwave background radiation measured by DASI • Polarization of DASI data • Observed violation of the GZK cutoff • Mass density of the universe • Large scale structure of the universe
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Continuing with the Committee's theoretical debate, page 13 of the present Office Action states:

While it is agreed that an inventor need not necessarily understand the theory behind his invention, attention is drawn to the fact that by reciting the phrases that include "hydrino atom" or equivalent terminology, such as, "hydrino hydride," "increased binding energy hydrogen species," etc. referring to something other than a "normal" hydrogen atom, in his claims, the applicant has ipso facto introduced his theory of the "hydrino atom" into the claims. Moreover, a similar interpretation of an invention occurred in *Newman v. Quigg*, op. cit., where an applicant's claims to a machine which operated according to a theory which violated the second law of thermodynamics were held to be unpatentable. Hence it is clear why the examiner is obliged to review applicant's theory in addition to evaluating the experimental evidence alleged to support patentability of the present claims. The applicant's theory is the unique source from which the existence of the "hydrino atom" is demonstrated. It is, therefore, natural and logical to interpret applicant's invention in terms of the basic underlying premise offered by applicant's theory.

The Committee's reference to *Newman* is ironic given its recognition that the machine in that case operated according to a theory that "violated the second law of thermodynamics." The Committee has completely failed in this case to similarly identify a single law of nature that has been violated by Applicant's disclosed invention. That is because, as Applicant has shown, the theory underlying his invention is correctly derived from, and thus in compliance with, physical laws. Applicant has further submitted real-world experimental evidence proving the disclosed reaction that forms lower-energy-state hydrogen, the states themselves, as well as novel compounds produced in the process, which evidence has not been credibly rebutted.

On page 14 of the present Office Action, the Committee further argues that:

In the amendments filed 3/10/2003 and 10/10/2003, applicant asserts that he has submitted a multitude of analytical studies experimentally confirming the disclosed novel reaction of atomic hydrogen, which produces hydrogen in fractional quantum states that are at lower energies than the traditional "ground" ($n=1$) state. In response, applicant's experimental results have already been addressed in the ATTACHMENT to paper #12 and can be explained by conventional science which does not involve the existence of the hydrino atom.

As demonstrably shown by Applicant's responses to the referenced paper and to the new attached Appendix authored by Examiner Bernard Souw, the proposed explanations by "conventional science" are easily defeated. Thus, Applicant sees no

need for further comment here, except in response to the specific examples the Committee erroneously cites as "scientific data that can be explained by conventional science without the need to use applicant's scientifically implausible theory of the hydrino atom," including the following taken from pages 14-15 of the present Office Action:

[A]pplicant's attention is directed to the document titled "Hydrocatalysis Technical Assessment, Prepared for Pacificorp, prepared by Technology Insights, dated August 2, 1996", submitted by applicant on 7/17/2002. According to the document on page 5, the applicant of the present application is the founder of Hydrocatalysis Power Corporation (IIPC) now known as Blacklight Power, Inc. Pages 20-21 of the document states that spectral data taken from the reference S. Labov and S. Bowyer, "Spectral Observations of the Extreme Ultraviolet Background", The Astrophysics Journal, 371, 810 (1991), were evaluated by HPC for indications of hydrino. HPC assigned peaks in the wavelength region of 80 to 650 Å to hydrino transitions. As shown in Table 4-1 on page 21 of the document, the HPC assignments contradict the alternative assignments made by the authors of the paper.

The explanation given by Labov and Bowyer is not credible. The data matches hydrinos and is now published in a peer-reviewed journal, R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", *Int. J. Hydrogen Energy*, (2002), Vol. 27, No. 3, pp. 301-322, and a Masters thesis. P. M. Jansson, "HydroCatalysis: A New Energy Paradigm for the 21st Century", Thesis Submitted in partial fulfillment of the requirements of the Masters of Science in Engineering Degree in the Graduate Division of Rowan University, May 1997, Thesis Advisors: Dr. J. L. Schmalzel, Dr. T. R. Chandrupatla, and Dr. A. J. Marchese, External Advisors: Dr. J. Phillips, Pennsylvania State University, Dr. R. L. Mills, BlackLight Power, Inc., W. R. Good, BlackLight Power, Inc.

The assignment of the interstellar spectra to hydrino has further been validated by the following:

B. Identification of Lower-Energy Hydrogen by Soft X-rays from Dark Interstellar Medium

a. Dark Matter

The Universe is predominantly comprised of hydrogen and a small amount of helium. These elements exist in interstellar regions of space, and they are expected to comprise the majority of interstellar matter. However, the observed constant angular velocity of many galaxies as the distance from the luminous galactic center increases can only be accounted for by the existence of nonluminous weakly interacting matter, dark matter. Dark matter exists at the cold fringes of galaxies and in cold interstellar space. It may account for the majority of the universal mass.

The identity of dark matter has been a cosmological mystery. Postulated assignments include ν neutrinos, but a detailed search for signature emissions has yielded nil [49]. The search for signatures by the Cryogenic Dark Matter Search (CDMS) developed to detect theorized Weakly Interacting Massive Particles (WIMPs) has similarly yielded nil [50-51]. WIMP theory's main competitor known as MACHO theory which assigns the dark matter to Massive Compact Halo Objects (MACHOs) which rather than elusive subatomic particles comprises ordinary baryonic matter in the form of burned-out dark stars, stray planets, and other large, heavy, but dark objects that must be ubiquitous throughout the universe. However, MACHO theory has also recently been ruled out based on lack of evidence of these dark objects observable by the brief ellipses caused by them moving in front of distant stars. Only a few such objects have been observed after exhaustively searching for over five years [50, 52].

It is anticipated that the emission spectrum of the extreme ultraviolet background of interstellar matter possesses the spectral signature of dark matter. Labov and Bowyer designed a grazing incidence spectrometer to measure and record the diffuse extreme ultraviolet background [53]. The instrument was carried aboard a sounding rocket, and data were obtained between 80 \AA and 650 \AA (data points approximately every 1.5 \AA). Several lines including an intense 635 \AA emission associated with dark matter were observed [53] which has considerable astrophysical importance as indicated by the authors:

"Regardless of the origin, the 635 \AA emission observed could be a major source of ionization. Reynolds (1983, 1984, 1985) has shown that diffuse $H\alpha$ emission is ubiquitous throughout the Galaxy, and widespread sources of flux

shortward of 912 \AA are required. Pulsar dispersion measures (Reynolds 1989) indicate a high scale height for the associated ionized material. Since the path length for radiation shortward of 912 \AA is low, this implies that the ionizing source must also have a large scale height and be widespread. Transient heating appears unlikely, and the steady state ionization rate is more than can be provided by cosmic rays, the soft X-ray background, B stars, or hot white dwarfs (Reynolds 1986; Brushweiler & Cheng 1988). Sciama (1990) and Salucci & Sciama (1990) have argued that a variety of observations can be explained by the presence of dark matter in the galaxy which decays with the emission of radiation below 912 \AA .

The flux of 635 \AA radiation required to produce hydrogen ionization is given by $F = \zeta_H / \sigma_\lambda = 4.3 \times 10^4 \zeta_{-13} \text{ photons cm}^{-2} \text{ s}^{-1}$, where ζ_{-13} is the ionizing rate in units of 10^{-13} s^{-1} per H atom. Reynolds (1986) estimates that in the immediate vicinity of the Sun, a steady state ionizing rate of ζ_{-13} between 0.4 and 3.0 is required. To produce this range of ionization, the 635 \AA intensity we observe would have to be distributed over 7% - 54% of the sky."

The first soft X-ray background was detected and reported [54] about 25 years ago. Quite naturally, it was assumed that these soft X-ray emissions were from ionized atoms within hot gases. Labov and Bowyer also interpreted the data as emissions from hot gases. However, the authors left the door open for some other interpretation with the following statement from their introduction:

"It is now generally believed that this diffuse soft X-ray background is produced by a high-temperature component of the interstellar medium. However, evidence of the thermal nature of this emission is indirect in that it is based not on observations of line emission, but on indirect evidence that no plausible non-thermal mechanism has been suggested which does not conflict with some component of the observational evidence."

The authors also state that "if this interpretation is correct, gas at several temperatures is present." Specifically, emissions were attributed to gases in three ranges: $5.5 < \log T < 5.7$; $\log T = 6$; $6.6 < \log T < 6.8$.

The explanation proposed herein of the observed dark interstellar medium spectrum hinges on the possibility of energy states below the $n = 1$ state, as

given by Eqs. (2a) and (3). A number of experimental observations discussed in the Introduction section lead to the conclusion that atomic hydrogen can exist in fractional quantum states that are at lower energies than the traditional "ground" ($n = 1$) state. The existence of fractional quantum states of hydrogen atoms explains the spectral observations of the extreme ultraviolet background emission from interstellar space [53], which may characterize dark matter as demonstrated in Table 3. (In these cases, a hydrogen atom in a fractional quantum state, $H(n_i)$, collides, for example, with a $n = \frac{1}{2}$ hydrogen atom, $H(\frac{1}{2})$, and the result is an even lower-energy hydrogen atom, $H(n_f)$, and $H(\frac{1}{2})$ is ionized.



The energy released, as a photon, is the difference between the energies of the initial and final states given by Eqs. (2a) and (3) minus the ionization energy of $H(\frac{1}{2})$, 54.4 eV.

Thus, lower-energy transitions of the type,

$$\Delta E = \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right) \times 13.6 \text{ eV} - 54.4 \text{ eV} \quad n = 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \text{ and } n_i > n_f \quad (56)$$

induced by a disproportionation reaction with $H\left[\frac{a_H}{2}\right]$ ought to occur. The

wavelength is related to ΔE by

$$\lambda \text{ (in } \text{\AA}) = \frac{1.240 \times 10^4}{\Delta E \text{ (in eV)}} \quad (57)$$

The energies and wavelengths of several of these proposed transitions are shown in Table 2. Note that the lower energy transitions are in the soft X-ray region.

b. The Data And Its Interpretation

In their analysis of the data, Labov and Bowyer [53] established several tests to separate emission features from the background. There were seven features (peaks) that passed their criteria. The wavelengths and other aspects of these peaks are shown in Table 3. Peaks 2 and 5 were interpreted by Labov and

Bowyer as instrumental second-order images of peaks 4 and 7, respectively.

Peak 3, the strongest feature, is clearly a helium resonance line:

$He(1s^1 2p^1 \rightarrow 1s^2)$. At issue here, is the interpretation of peaks 1, 4, 6, and 7. It is proposed that peaks 4, 6, and 7 arise from the $\frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, and $\frac{1}{6} \rightarrow \frac{1}{7}$

hydrogen atoms transitions given by Eq. (55). It is also proposed that peak 1 arises from inelastic helium scattering of peak 4. That is, the $\frac{1}{3} \rightarrow \frac{1}{4}$ transition yields a 40.8 eV photon (303.9 Å). Conspicuously absent is the 256 Å (48.3 eV) line of He II which eliminates the assignment of the majority of the 303 Å line to the He II transition. When this photon strikes $He(1s^2)$, 21.2 eV is absorbed in the excitation to $He(1s^1 2p^1)$. This leaves a 19.6 eV photon (632.6 Å), peak 1. For these four peaks, the agreement between the predicted values (Table 2) and the experimental values (Table 3) is remarkable.

One argument against this new interpretation of the data is that the transition $\frac{1}{5} \rightarrow \frac{1}{6}$ is missing—predicted at 130.2 Å by Eqs. (56-57). This missing peak cannot be explained into existence, but a reasonable rationale can be provided for why it might be missing from these data. The data obtained by Labov and Bowyer are outstanding when the region of the spectrum, the time allotted for data collection, and the logistics are considered. Nonetheless, it is clear that the signal-to-noise ratio is low and that considerable effort had to be expended to differentiate emission features from the background. This particular peak, $\frac{1}{5} \rightarrow \frac{1}{6}$, is likely to be only slightly stronger than the $\frac{1}{6} \rightarrow \frac{1}{7}$ peak (the intensities, Table 3, appear to decrease as n decreases), which has low intensity. Labov and Bowyer provided their data (wavelength, count, count error, background, and background error). The counts minus background values for the region of interest, 130.2 ± 5 Å, are shown in Table 4 (the confidence limits for the wavelength of about ± 5 Å are the single-side 1 confidence levels and include both the uncertainties in the fitting procedure and uncertainties in the wavelength calibration). Note that the largest peak (count – background) is at 129.64 Å and has a *counts – background* = 8.72. The *counts – background* for the strongest signal of the other hydrino transitions are: $n = 1/3$ to $n = 1/4$, 20.05; $n = 1/4$ to $n = 1/5$, 11.36; $n = 1/6$ to $n = 1/7$, 10.40. Thus, there is fair agreement with the wavelength and the strength of the signal. This, of course, does not mean that there is a peak at 130.2 Å. However, it is not unreasonable to conclude that a

spectrum with a better signal-to-noise ratio might uncover the missing peak. With the assignment of the $\frac{1}{5} \rightarrow \frac{1}{6}$ transition, all of the hydrogen transitions $\frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, $\frac{1}{5} \rightarrow \frac{1}{6}$, and $\frac{1}{6} \rightarrow \frac{1}{7}$ are observed over the recorded spectral range, and the 632.6 Å peak is identified.

The Committee then continues on page 15 of the present Office Action, with the following additional argument:

Page 21 of the document also states that Bowyer (an astrophysicist and author of the astrophysics journal paper cited above) disputed the HPC interpretation of the data and that the paper on the HPC interpretation submitted to the Astrophysical Letters and Communications was not accepted for publication. The document also states on page 21 that the low energy hydrogen concept and its implications regarding data interpretation has not received general review or acceptance by the astrophysics community. Thus, applicant's assertions regarding the existence of hydrino based on observations of radiation spectra from space, i.e., astrophysical data, have not been accepted by the astrophysics community as evidenced by the document submitted by applicant on 7/17/2002 since a more credible scientific alternative exists to explain the spectral data.

Again, the explanation given by Labov and Bowyer is not credible, as discussed above. The data matches hydrinos and is now published in a peer-reviewed journal. [See R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322.] Furthermore, several peer-reviewed articles have been published that directly show and assign the hydrino spectra lines:

67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.
50. R. L. Mills, P. Ray, J. Dong, M. Nansteel, B. Dhandapani, J. He, "Spectral Emission of Fractional-Principal-Quantum-Energy-Level Atomic and Molecular Hydrogen", Vibrational Spectroscopy, Vol. 31, No. 2, (2003), pp. 195-213.

33. R. L. Mills, P. Ray, B. Dhandapani, M. Nansteel, X. Chen, J. He, "New Power Source from Fractional Quantum Energy Levels of Atomic Hydrogen that Surpasses Internal Combustion", J Mol. Struct., Vol. 643, No. 1-3, (2002), pp. 43-54.
29. R. Mills, P. Ray, "Vibrational Spectral Emission of Fractional-Principal-Quantum-Energy-Level Hydrogen Molecular Ion", Int. J. Hydrogen Energy, Vol. 27, No. 5, (2002), pp. 533-564.
28. R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, (2002), Vol. 27, No. 3, pp. 301-322.

Assignments to known species and contaminants were investigated and ruled out. For example, extreme ultraviolet (EUV) spectroscopy was recorded on microwave discharges of helium with 2% hydrogen. Novel emission lines were observed with energies of $q \cdot 13.6 \text{ eV}$, $q = 1, 2, 3, 7, 9, 11$. or $q \cdot 13.6 \text{ eV}$, $q = 4, 6, 8$ less 21.2 eV corresponding to inelastic scattering of these photons by helium atoms due to excitation of $He(1s^2)$ to $He(1s^1 2p^1)$. These strong emissions are not found in any single gas plasma, and cannot be assigned to the known emission of any species of the single gases studied such as H , H^- , H_2 , H_2^+ , H_3^+ , He , He_2^+ , and He^+ , known species of the mixture such as He_2^+ , HeH^+ , HeH , HHe_2^+ , and HHe_n^+ and He_n , or possible contaminants as given in Ref. 67.

Journal article No. 67 was published in J. Phys. D, a top-tiered physics journal. The spectra discussed in that article were extensively peer reviewed and the publication unequivocally assigns the lines to hydrino:

The elimination of known explanations indicate a new result. Since the novel peaks were only observed with helium and hydrogen present, new hydrogen, helium, or helium-hydrogen species are possibilities. It is well known that empirically the excited energy states of atomic hydrogen are given by Rydberg equation (Eq. (2a) for $n > 1$ in Eq. (2b)).

$$E_n = -\frac{e^2}{n^2 8 \pi \epsilon_0 a_H} = -\frac{13.598 \text{ eV}}{n^2} \quad (2a)$$

$$n = 1, 2, 3, \dots \quad (2b)$$

The $n = 1$ state is the "ground" state for "pure" photon transitions (i.e. the $n = 1$ state can absorb a photon and go to an excited electronic state, but it cannot release a photon and go to a lower-energy electronic state). However, an electron transition from the ground state to a lower-energy state may be possible by a resonant nonradiative energy transfer such as multipole coupling or a resonant collision mechanism. Processes such as hydrogen molecular bond formation that occur without photons and that require collisions are common [47]. Also, some commercial phosphors are based on resonant nonradiative energy transfer involving multipole coupling [48].

We propose that atomic hydrogen may undergo a catalytic reaction with certain atoms and ions such as He^+ which singly or multiply ionize at integer multiples of the potential energy of atomic hydrogen, $m \cdot 27.2 \text{ eV}$ wherein m is an integer. The theory was given previously [49]. The reaction involves a nonradiative energy transfer to form a hydrogen atom that is lower in energy than unreacted atomic hydrogen that corresponds to a fractional principal quantum number. That is

$$n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}; \quad p \text{ is an integer; } p \leq 137 \quad (2c)$$

replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. Thus, the Rydberg states are extended to lower levels as depicted in Figure 9. The $n = 1$ state of hydrogen and the $n = \frac{1}{\text{integer}}$ states of hydrogen are

nonradiative, but a transition between two nonradiative states is possible via a nonradiative energy transfer, say $n = 1$ to $n = 1/2$. Thus, a catalyst provides a net positive enthalpy of reaction of $m \cdot 27.2 \text{ eV}$ (i.e. it resonantly accepts the nonradiative energy transfer from hydrogen atoms and releases the energy to the surroundings to affect electronic transitions to fractional quantum energy levels). As a consequence of the nonradiative energy transfer, the hydrogen atom becomes unstable and emits further energy until it achieves a lower-energy nonradiative state having a principal energy level given by Eqs. (2a) and (2c).

The novel peaks fit two empirical relationships. In order of energy, the set comprising the peaks at 91.2 nm , 45.6 nm , 30.4 nm , 13.03 nm , 10.13 nm , and 8.29 nm correspond to energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 7, 9, 11$. In order of energy, the set comprising the peaks at 37.4 nm , 20.5 nm , and 14.15 nm correspond to energies of $q \cdot 13.6 - 21.21 \text{ eV}$ where $q = 4, 6, 8$. These lines can be explained as electronic transitions to fractional Rydberg states of atomic hydrogen given by Eqs. (2a) and (2c) wherein the catalytic system involves helium ions because the second ionization

energy of helium is 54.417 eV , which is equivalent to $2 \cdot 27.2 \text{ eV}$. In this case, 54.417 eV is transferred nonradiatively from atomic hydrogen to He^+ which is resonantly ionized. The electron decays to the $n = 1/3$ state with the further release of 54.417 eV which may be emitted as a photon. The catalysis reaction is

$$54.417 \text{ eV} + \text{He}^+ + \text{H}[a_H] \rightarrow \text{He}^{2+} + e^- + \text{H}\left[\frac{a_H}{3}\right] + 108.8 \text{ eV} \quad (3)$$

$$\text{He}^{2+} + e^- \rightarrow \text{He}^+ + 54.417 \text{ eV} \quad (4)$$

And, the overall reaction is

$$\text{H}[a_H] \rightarrow \text{H}\left[\frac{a_H}{3}\right] + 54.4 \text{ eV} + 54.4 \text{ eV} \quad (5)$$

Since the products of the catalysis reaction have binding energies of $m \cdot 27.2 \text{ eV}$, they may further serve as catalysts. Thus, further catalytic transitions may occur: $n = \frac{1}{3} \rightarrow \frac{1}{4}$, $\frac{1}{4} \rightarrow \frac{1}{5}$, and so on.

Electronic transitions to Rydberg states given by Eqs. (2a) and (2c) catalyzed by the resonant nonradiative transfer of $m \cdot 27.2 \text{ eV}$ would give rise to a series of emission lines of energies $q \cdot 13.6 \text{ eV}$ where q is an integer. It is further proposed that the photons that arise from hydrogen transitions may undergo inelastic helium scattering. That is, the catalytic reaction

$$\text{H}[a_H] \xrightarrow{\text{He}^+} \text{H}\left[\frac{a_H}{3}\right] + 54.4 \text{ eV} + 54.4 \text{ eV} \quad (6)$$

yields 54.4 eV by Eq. (4) and a photon of 54.4 eV (22.8 nm). Once emitted, the photon may be absorbed or scattered. When this photon strikes $\text{He}(1s^2)$, 21.2 eV may be absorbed in the excitation to $\text{He}(1s^1 2p^1)$. This leaves a 33.19 eV (37.4 nm) photon peak and a 21.21 eV (58.4 nm) photon from $\text{He}(1s^1 2p^1)$. Thus, for helium the inelastic scattered peak of 54.4 eV photons from Eq. (3) is given by

$$E = 54.4 \text{ eV} - 21.21 \text{ eV} = 33.19 \text{ eV} \text{ (37.4 nm)} \quad (7)$$

A novel peak shown in Figures 2-4 was observed at 37.4 nm . Furthermore, the intensity of the 58.4 nm peak corresponding to the spectra shown in Figure 4 was about 60,000 photons/sec. Thus, the transition $\text{He}(1s^2) \rightarrow \text{He}(1s^1 2p^1)$ dominated the inelastic scattering of EUV peaks. The general reaction is

$$\text{photon}(h\nu) + \text{He}(1s^2) \rightarrow \text{He}(1s^1 2p^1) + \text{photon}(h\nu - 21.21 \text{ eV}) \quad (8)$$

The two empirical series may be combined—one directly from Eqs. (2a, 2c) and the other indirectly with Eq. (8). The energies for the novel lines in order of energy are 13.6 eV , 27.2 eV , 40.8 eV , 54.4 eV , 81.6 eV , 95.2 eV , 108.8 eV , 122.4 eV and 149.6 eV . The corresponding peaks are 91.2 nm , 45.6 nm , 30.4 nm , 37.4 nm ,

20.5 nm , 13.03 nm , 14.15 nm , 10.13 nm , and 8.29 nm , respectively. Thus, the identified novel lines correspond to energies of $q \cdot 13.6 \text{ eV}$, $q = 1,2,3,7,9,11$. or $q \cdot 13.6 \text{ eV}$, $q = 4,6,8$ less 21.2 eV corresponding to inelastic scattering of these photons by helium atoms due to excitation of $\text{He}(1s^2)$ to $\text{He}(1s^1 2p^1)$. The values of q observed are consistent with those expected based on Eq. (5) and the subsequent autocatalyzed reactions as discussed previously [50]. The broad satellite peak at 44.2 nm show in Figure 2-4 is consistent with the reaction mechanism of a nonradiative transfer to a catalyst followed by emission. There is remarkable agreement between the data and the proposed transitions to fractional Rydberg states and these lines inelastically scattered by helium according to Eq. (8). All other peaks could be assigned to He I, He II, second order lines, or atomic or molecular hydrogen emission. No known lines of helium or hydrogen explain the $q \cdot 13.6 \text{ eV}$ related set of peaks.

In yet another supposed plausible explanation of Applicant's scientific data by "conventional science," the Committee states on pages 15-16 of the present Office Action:

Applicant has submitted plasma data that allegedly prove the existence of the hydrino atom in the information disclosure statements filed above. It is noted that these references submitted are applicant's own work which have not been reproduced and verified by independent laboratories. Nevertheless, the Examiner is unpersuaded by applicant's plasma data. For example, applicant's interpretation of the observation of line broadening in the plasma data due to a resonance transfer mechanism (r-t mechanism) is unconvincing because alternative conventional explanations are equally plausible to explain the line broadening observed in the plasma data. It is well known that hydrogen transitions are easily perturbed by the plasma and microwave fields, since the atomic hydrogen has only one electron that is not protected by screening effects, especially those having large l quantum numbers. Anomalous broadening of hydrogen lines in microwave plasma has been subjected to experimental and theoretical studies for decades (see Luggenhölscher et al. "Investigations on Electric Field Distributions in a Microwave Discharge in Hydrogen", obtained from <URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.Pdf>>).

Contrary to these statements, Applicant's results have been independently reproduced, and the results have been found to only be explicable by energy transfer

during the formation of lower-energy hydrogen. From Applicant's "Independent Test Results":

51. J. Phillips, C-K Chen, R. Mills, "Evidence of catalytic Production of Hot Hydrogen in RF Generated Hydrogen/Argon Plasmas", IEEE Transactions on Plasma Science, submitted.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. This is the third in a series of papers by our team on apparently anomalous Balmer series line broadening in hydrogen containing RF generated, low pressure (< 600 mTorr) plasmas. In this paper the selective broadening of the atomic hydrogen lines in pure H_2 and Ar/H_2 mixtures in a large "GEC" cell (36 cm length X 14 cm ID) was mapped as a function of position, H_2/Ar ratio, time, power, and pressure. Several observations regarding the selective line broadening were particularly notable as they are unanticipated on the basis of earlier models. First, the anomalous broadening of the Balmer lines was found to exist throughout the plasma, and not just in the region between the electrodes. Second, the broadening was consistently a complex function of the operating parameters particularly gas composition (highest in pure H_2) position, power and pressure. Clearly not anticipated by earlier models were the findings that under some conditions the highest concentration of "hot" (>10 eV) hydrogen was found at the entry end, and not in the high field region between the electrodes and that in other conditions, the hottest H was at the (exit) pump (also grounded electrode) end. Third, excitation and electron temperatures were less than one eV in all regions of the plasma not directly adjacent (>1 mm) to the electrodes, providing additional evidence that the energy for broadening, contrary to standard models, is not obtained from the field. Fourth, in contrast to our earlier studies of hydrogen/helium and water plasmas, we found that in some conditions 98% of the atomic hydrogen was in the "hot" state throughout the GEC cell. Virtually every operating parameter studied impacted the character of the hot H atom population, and clearly second and third order effects exist, indicating a need for experimental design. Some non-field mechanisms for generating hot hydrogen atoms, specifically those suggested by Mills' CQM model, are outlined.

50. J. Phillips, C. K. Chen, R. Mills, "Evidence of the Production of Hot Hydrogen Atoms in RF Plasmas by Catalytic Reactions Between Hydrogen and Oxygen Species", *Spectrochimica Acta Part B: Atomic Spectroscopy*, submitted.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies of line broadening in catalysis plasmas. Selective H-atom line broadening was found to be present throughout the volume (13.5 cm ID x 38 cm length) of RF generated H_2O plasmas in a GEC cell. Notably, at low pressures (ca. <0.08 Torr), a significant fraction (ca. 20%) of the atomic hydrogen was 'hot' with energies greater than 40 eV with a pressure dependence, but only a weak power dependence. The degree of broadening was virtually independent of the position studied within the GEC cell, similar to the recent finding for He/H_2 plasmas in the same GEC cell. In contrast to the atomic hydrogen lines, no broadening was observed in oxygen species lines at low pressures. Also, in 'control' Xe/H_2 plasmas run in the same cell at similar pressures and adsorbed power, no significant broadening of atomic hydrogen, Xe , or any other lines was observed. Stark broadening or acceleration of charged species due to high electric fields can not explain the results since i) the electron density was insufficient by orders of magnitude, ii) the RF field was essentially confined to the cathode fall region in contrast to the broadening that was independent of position, and iii) only the atomic hydrogen lines were broadened. Rather, all of the data is consistent with a model that claims specific, predicted, species can act catalytically through a resonant energy transfer mechanism to create 'hot' hydrogen atoms in plasmas.

48. J. Phillips, C. K. Chen, "Evidence of Energetic Reaction Between Helium and Hydrogen Species in RF Generated Plasmas", *Philosophy Magazine*, submitted.

A study of the line shapes of hydrogen Balmer series lines in RF generated low pressure H_2/He plasmas performed at the University of New Mexico, Department of Chemical and Nuclear Engineering produced results suggesting a catalytic process between helium and hydrogen species results in the generation of 'hot' (ca. 28 eV) atomic hydrogen. Even far from the electrodes (ca. 15 cm) both 'cold' (<2.5 eV) and 'hot' atomic hydrogen were found in H_2/He plasmas. Line shapes, relative line areas of cold and hot atomic hydrogen (hot/cold>2.5), were very similar for areas between the electrodes and far from the electrodes for these plasmas. In contrast, in H_2/Xe only 'warm' (<5 eV) hydrogen (warm/cold<1.0) was found between the electrodes, and only

cold hydrogen away from the electrodes. Earlier postulates that preferential hydrogen line broadening in plasmas results from the acceleration of ionic hydrogen in the vicinity of electrodes, and the special charge exchange characteristics of Ar/H_2^+ are clearly belied by the present results that show atomic hydrogen line shape are similar for H_2/He plasmas throughout the relatively large cylindrical (14 cm ID x 36 cm length) cavity.

47. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, Luca Gamberale, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source", J. Phys. B: At. Mol. Opt. Phys., submitted.

Luca Gamberale of the Advanced Research - Pirelli Labs, Milan, Italy performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of a chemically generated hydrogen plasma, extraordinarily broadened atomic hydrogen lines, lower-energy hydrogen molecular-ion lines, the isolation and characterization of lower-energy molecular hydrogen gas, and excess power measured by water bath calorimetry were replicated. Specifically, plasmas of certain catalysts such as Sr^+ , Ar^+ , and He^+ mixed with hydrogen were studied for evidence of a novel energetic reaction. A hydrogen plasma was observed to form at low temperatures (e.g. $\approx 10^3 \text{ K}$) and an extraordinary low field strength of about 1-2 V/cm when argon and strontium were present with atomic hydrogen. RF and microwave plasmas were used to generate He^+ and Ar^+ catalysts. Extraordinarily fast H (40-50 eV) was observed by Balmer α line broadening only from plasmas having a catalyst with H. Novel emission lines with energies of $q \cdot 13.6 \text{ eV}$ where $q = 1, 2, 3, 4, 6, 7, 8, 9$, or 11 were previously observed by extreme ultraviolet (EUV) spectroscopy recorded on microwave discharges of helium with 2% hydrogen [R. L. Mills, P. Ray, J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542]. These lines matched $H(1/p)$, fractional Rydberg states of atomic hydrogen wherein $n = \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{p}$; ($p \leq 137$ is an integer) replaces the well known parameter $n = \text{integer}$ in the Rydberg equation for hydrogen excited states. $H(1/p)$ may react with a proton and two $H(1/p)$ may react to form $\text{H}_2(1/p)^+$ and $\text{H}_2(1/p)$, respectively, that have vibrational and rotational energies that are p^2 times those of the species comprising uncatalyzed atomic hydrogen. A series of over twenty peaks in the 10-65 nm region emitted from low-pressure helium-hydrogen (90/10%) and argon-hydrogen (90/10%) microwave plasmas matched the energy spacing of 2^2 times the transition-state vibrational energy

of H_2^+ with the series ending on the bond energy of $H_2(1/4)^+$. $H_2(1/p)$ gas was isolated by liquefaction using an high-vacuum (10^{-6} Torr) capable, liquid nitrogen cryotrap and was characterized by gas chromatography (GC), mass spectroscopy (MS), visible and EUV optical emission spectroscopy (OES), and 1H NMR of the condensable gas dissolved in $CDCl_3$. Novel peaks were observed by cryogenic gas chromatography performed on the condensable gas which was highly pure hydrogen by MS and had a higher ionization energy than H_2 . The observation that the EUV emission spectrum changed with deuterium substitution in a region where no hydrogen emission has ever been observed further supported the existence of lower-energy molecular hydrogen. Contaminants and exotic helium-hydrogen species were eliminated as the source of the reaction and condensed gas plasma emission spectra. Upfield shifted NMR peaks were observed at 3.47 ppm and 2.18 ppm compared to that of H_2 at 4.63 ppm that matched $H_2(1/2)$ and $H_2(1/4)$, respectively. Excess power was absolutely measured from the helium-hydrogen plasma. For an input of 44.3 W, the total plasma power of the helium-hydrogen plasma measured by water bath calorimetry was 62.9 W corresponding to 18.6 W of excess power in 3 cm^3 . The excess power density and energy balance were high, 6.2 W/cm^3 and $-5 \times 10^4\text{ kJ/mole } H_2$ (240 eV/H atom), respectively.

44. A. J. Marchese, P. M. Jansson, J. L. Schmalzel, "The BlackLight Rocket Engine", Phase I Final Report, NASA Institute for Advanced Concepts Phase I, May 1-November 30, 2002,

http://www.niac.usra.edu/files/studies/final_report/pdf/752Marchese.pdf.

Rowan University Professors A. J. Marchese, P. M. Jansson, J. L. Schmalzel performed verification studies as visiting researchers at BlackLight Power, Cranbury, NJ. The prior reported results of BlackLight Power, Inc. of extraordinarily broadened atomic hydrogen lines, population inversion, lower-energy hydrogen lines, and excess power measured by water bath calorimetry were replicated. The application of the energetic hydrogen to propulsion was studied.

Specifically, the data supporting hydrinos was replicated. See

- i.) BlackLight Process Theory (pp. 10-12) which gives the theoretical energy levels for hydrinos and the catalytic reaction to form hydrinos,
- ii.) Unique Hydrogen Line Broadening in Low Pressure Microwave Water Plasmas (pp. 25-27, particularly Fig. 21) which shows that in the same microwave cavity driven at the same power, the temperature of the hydrogen atoms in the microwave

plasma where the hydrino reaction was active was 50 times that of the control based on the spectroscopic line widths,

iii.) Inversion of the Line Intensities in Hydrogen Balmer Series (pp. 27-28, particularly Fig. 22) which shows for the first time in 40 years of intensive worldwide research that atomic hydrogen population inversion was achieved in a steady state plasma and supports the high power released from the reaction of hydrogen to form hydrinos,

iv.) Novel Vacuum Ultraviolet (VUV) Vibration Spectra of Hydrogen Mixture Plasmas (pp. 28-29, particularly Fig. 23) which shows a novel vibrational series of lines in a helium-hydrogen plasmas at energies higher than any known vibrational series and it identically matches the theoretical prediction of 2 squared times the corresponding vibration of the ordinary hydrogen species, and

v.) Water Bath Calorimetry Experiments Showing Increased Heat Generation (pp. 29-30, particularly Fig. 25) that shows that with exactly the same system and same input power, the heating of the water reservoir absolutely measured to 1% accuracy was equivalent to 55 to 62 W with the catalyst-hydrogen mixture compared to 40 W in the control without the possibility of the reaction to form hydrinos.

43. J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas", *Journal of Applied Physics*, Vol. 96, No. 6, pp. 3095-3102.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. Water bath calorimetry was used to demonstrate one more peculiar phenomenon associated with a certain class of mixed gas plasmas termed resonant transfer, or rt-plasmas. Specifically, $He/H_2(10\%)$ (500 mTorr), $Ar/H_2(10\%)$ (500 mTorr), and $H_2O(g)$ (200 mTorr) plasmas generated with an Evenson microwave cavity consistently yielded on the order of 50% more heat than non rt-plasma (controls) such as He , Kr , $Kr/H_2(10\%)$, under identical conditions of gas flow, pressure, and microwave operating conditions. The excess power density of rt-plasmas was of the order $10\ W \cdot cm^{-3}$. In earlier studies with these same rt-plasmas it was demonstrated that other unusual features were present including dramatic broadening of the hydrogen Balmer series lines, unique vacuum ultraviolet (VUV) lines, and in the case of water plasmas, population inversion of the hydrogen excited states. Both the current results and the earlier results are completely consistent with the

existence of a hitherto unknown exothermic chemical reaction, such as that predicted by Mills, occurring in rt-plasmas.

42. R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Line Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas", J. Plasma Phys., submitted.

J. Phillips, Distinguished National Laboratory Professor at Los Alamos National Laboratory and University of New Mexico, performed verification studies as a visiting researcher at BlackLight Power, Cranbury, NJ. It was demonstrated that low pressure (~ 0.2 Torr) water vapor plasmas generated in a 10 mm ID quartz tube with an Evenson microwave cavity show at least two features which are not explained by conventional plasma models. First, significant ($> 2.5 \text{ \AA}$) hydrogen Balmer α line broadening was recorded, of constant width, up to 5 cm from the microwave coupler. Only hydrogen, and not oxygen, showed significant line broadening. This feature, observed previously in hydrogen-containing mixed gas plasmas generated with high voltage DC and RF discharges was explained by some researchers to result from acceleration of hydrogen ions near the cathode. This explanation cannot apply to the line broadening observed in the (electrodeless) microwave plasmas generated in this work, particularly at distances as great as 5 cm from the microwave coupler. Second, dramatic inversion of the line intensities of both the Lyman and Balmer series, again, at distances up to 5 cm from the coupler were observed. The dramatic line inversion suggests the existence of a hitherto unknown source of pumping of the optical power in plasmas. Finally, it is notable that other aspects of the plasma including the OH^* rotational temperature and low electron concentrations are quite typical of plasmas of this type.

The broadening reported in the Committee's reference URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf> is 0.37 cm^{-1} with no field and 3.7 cm^{-1} with the application of the microwave field. The energies corresponding to these widths are $4.5 \times 10^{-5} \text{ eV}$ and $4.5 \times 10^{-4} \text{ eV}$, respectively, which is absolutely negligible compared to the $>10 \text{ eV}$ hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The Committee's alternative explanation is off by six orders of magnitude.

The common mechanisms presented by Committee were considered and eliminated as negligible. From #49. R. L. Mills, P. Ray, B. Dhandapani, J. He,

"Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355:

We have assumed that Doppler broadening due to thermal motion was the dominant source to the extent that other sources may be neglected. To justify this assumption, each source is now considered. In general, the experimental profile is a convolution of a Doppler profile, an instrumental profile, the natural (lifetime) profile, Stark profiles, Van der Waals profiles, a resonance profile, and fine structure. The instrumental half-width is measured to be $\pm 0.006 \text{ nm}$. The natural half-width of the Balmer α line given by Djurovic and Roberts [10] is $1.4 \times 10^{-4} \text{ nm}$ which is negligible. The fine structure splitting is also negligible.

Stark broadening of hydrogen lines in plasmas can not be measured at low electron densities using conventional emission or absorption spectroscopy because it is hidden by Doppler broadening. In the case of the Lyman α line, the Stark width exceeds the Doppler width only at $n_e > 10^{17} \text{ cm}^{-3}$ for temperatures of about 10^4 K [34]. Gigos and Cardenoso [35] give the observed Balmer α Stark broadening for plasmas of hydrogen with helium or argon as a function of the electron temperature and density. For example, the Stark broadening of the Balmer α line recorded on a $H + He^+$ plasma is only 0.033 nm with $T_e = 20,000 \text{ K}$ and $n_e = 1.4 \times 10^{14} \text{ cm}^{-3}$.

The relationship between the Stark broadening $\Delta\lambda_s$ of the Balmer β line in nm , the electron density n_e in m^{-3} , and the electron temperature T_e in K is

$$\log n_e = C_0 + C_1 \log(\Delta\lambda_s) + C_2 [\log(\Delta\lambda_s)]^2 + C_3 \log(T_e) \quad (5)$$

where $C_0 = 22.578$, $C_1 = 1.478$, $C_2 = -0.144$, and $C_3 = 0.1265$ [36]. From Eq. (5), to get a Stark broadening of only 0.1 nm with $T_e = 9000 \text{ K}$, an electron density of about $n_e \sim 3 \times 10^{15} \text{ cm}^{-3}$ is required, compared to that of the argon-hydrogen plasma of $< 10^9 \text{ cm}^{-3}$ determined using a compensated Langmuir probe, over six orders of magnitude less. Regional maxima in electron densities that could give rise to Stark broadening was eliminated as a possibility. The measured electron densities did not exceed 10^9 cm^{-3} , and the axial variation was weak, showing less than a factor of two change throughout the brightest region of the plasma. The high mass diffusivity of all of the species present made it unlikely that a large density gradient existed anywhere in the plasma at steady state. This result was also evident by the good fit to a Gaussian profile recorded on the argon-hydrogen plasma rather than a Voigt profile as shown in Figure 10. In addition, the line broadening for Balmer β , γ , and

δ was comparable to that of Balmer α ; whereas, an absence of broadening beyond the instrument width was observed for the lines of argon or helium species such as the 667.73 nm and 591.2 nm Ar I lines and 667.816 nm and 587.56 nm He I lines. Thus, the Stark broadening was also insignificant.

A linear Stark effect arises from an applied electric field that splits the energy level with principal quantum number n into $(2n - 1)$ equidistant sublevels. The magnitude of this effect given by Videnovic et al. [8] is about $2 \times 10^{-2} \text{ nm} / \text{kV} \cdot \text{cm}^{-1}$. No appreciable applied electric field was present in our study; thus, the linear Stark effect should be negligible. The absence of broadening of the noble gas lines and the hydrogen lines of the controls confirmed the absence of a strong electric field. No charged resonator cavity surfaces were present since the plasmas was contained in a quartz tube with the cavity external to the tube. A microwave E-mode field does exist in the Evenson cavity that is a function of the reflected power [37-38], and the catalysis reaction is dependent on this field as discussed previously [39]. However, there is no cathode fall region and the magnitude of the microwave field is comparably much less than that found in the cathode fall region of a glow discharge cell.

To investigate whether the rt-plasmas of this study were optically thin or thick at a given frequency ω , the effective path length $\tau_\omega(L)$ was calculated from

$$\tau_\omega(L) = \kappa_\omega L \quad (5)$$

where L is the path length and κ_ω is the absorption coefficient given by

$$\kappa_\omega = \sigma_\omega N_H \quad (7)$$

where σ_ω is the absorption cross section and N_H is the number density of the absorber. For optically thin plasmas $\tau_\omega(L) < 1$, and for optically thick plasmas $\tau_\omega(L) > 1$. The absorption cross section for Balmer α emission is $\sigma = 1 \times 10^{-16} \text{ cm}^2$ [40]. By methods discussed previously [41-42], an estimate of the $n=2$ H atom density based on Lyman line intensity is $\sim 1 \times 10^8 \text{ cm}^{-3}$. Thus, for a plasma length of 5 cm, $\tau_\omega(5 \text{ cm})$ for Balmer α is

$$\tau_\omega(5 \text{ cm}) = \kappa_\omega L = (1 \times 10^{-16} \text{ cm}^2)(1 \times 10^8 \text{ cm}^{-3})(5 \text{ cm}) = 5 \times 10^{-8} \quad (8)$$

Since $\tau_\omega(5) \ll 1$, the argon-hydrogen plasmas were optically thin; so, the self absorption of 656.3 nm emission by $n=2$ state atomic hydrogen may be neglected as a source of the observed broadening.

As discussed above, an estimate based on emission line profiles places the total H atom density of the argon-hydrogen plasma at $\sim 3.5 \times 10^{14} \text{ cm}^{-3}$. Since this is overwhelmingly dominated by the ground state, $N_H = 3.5 \times 10^{14} \text{ cm}^{-3}$ will be used.

Usually, the atomic hydrogen collisional cross section in plasmas is on the order of 10^{-18} cm^2 [43]. Thus, for $N_H = 3.5 \times 10^{14} \text{ cm}^{-3}$, collisional or pressure broadening is negligible.

In still another failed example of a supposed conventional scientific explanation for Applicant's data, the Committee asserts on page 16 of the present Office Action:

In the reference by Mills et al. titled "Comparison of Excessive Balmer α Line Broadening of Glow Discharge and Microwave Hydrogen Plasmas with Certain Catalysts" that was cited in the information disclosure statement filed on 7/17/2002 (hereinafter referred to as 'Mills et al. "Comparison of Excessive Balmer α Line Broadening" document'), applicant asserts that the broadening of the hydrogen Balmer α line in microwave discharge plasma of a mixture containing predominantly argon and small amounts of hydrogen can be explained by a radiative transfer mechanism involving the species providing a net enthalpy of a multiple of 27.2 eV and atomic hydrogen (see p. 3 and 5 of Mills et al. "Comparison of Excessive Balmer α Line Broadening" document). However, conventional alternative theories can explain the broadening of the H α lines in the microwave discharge plasma of the Ar/H mixture as evidenced by Luque et al. "Experimental research into the influence of ion dynamics when measuring the electron density from the Stark broadening of the H α and H β lines", *J. Phys. B: At. Mol. Opt. Phys.* 36 (2003) pp. 1573-1584 and Luggenhölscher et al. "Investigations on Electric Field Distributions in a Microwave Discharge in Hydrogen", obtained from <URL: [p://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf](http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf)>.

The common mechanisms presented by Luque were considered and eliminated as negligible. From #49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", *IEEE Transactions on Plasma Science*, Vol. 31, No. (2003), pp. 338-355:

We have assumed that Doppler broadening due to thermal motion was the dominant source to the extent that other sources may be neglected. To justify this assumption, each source is now considered. In general, the experimental profile is a convolution of a Doppler profile, an instrumental profile, the natural (lifetime) profile, Stark profiles, Van der Waals profiles, a resonance profile, and

fine structure. The instrumental half-width is measured to be $\pm 0.006 \text{ nm}$. The natural half-width of the Balmer α line given by Djurovic and Roberts [10] is $1.4 \times 10^{-4} \text{ nm}$ which is negligible. The fine structure splitting is also negligible.

Stark broadening of hydrogen lines in plasmas can not be measured at low electron densities using conventional emission or absorption spectroscopy because it is hidden by Doppler broadening. In the case of the Lyman α line, the Stark width exceeds the Doppler width only at $n_e > 10^{17} \text{ cm}^{-3}$ for temperatures of about 10^4 K [34]. Gigosos and Cardenoso [35] give the observed Balmer α Stark broadening for plasmas of hydrogen with helium or argon as a function of the electron temperature and density. For example, the Stark broadening of the Balmer α line recorded on a $H + He^+$ plasma is only 0.033 nm with $T_e = 20,000 \text{ K}$ and $n_e = 1.4 \times 10^{14} \text{ cm}^{-3}$.

The relationship between the Stark broadening $\Delta\lambda_s$ of the Balmer β line in nm , the electron density n_e in m^{-3} , and the electron temperature T_e in K is

$$\log n_e = C_0 + C_1 \log(\Delta\lambda_s) + C_2 [\log(\Delta\lambda_s)]^2 + C_3 \log(T_e) \quad (5)$$

where $C_0 = 22.578$, $C_1 = 1.478$, $C_2 = -0.144$, and $C_3 = 0.1265$ [36]. From Eq. (5), to get a Stark broadening of only 0.1 nm with $T_e = 9000 \text{ K}$, an electron density of about $n_e \sim 3 \times 10^{15} \text{ cm}^{-3}$ is required, compared to that of the argon-hydrogen plasma of $< 10^9 \text{ cm}^{-3}$ determined using a compensated Langmuir probe, over six orders of magnitude less. Regional maxima in electron densities that could give rise to Stark broadening was eliminated as a possibility. The measured electron densities did not exceed 10^9 cm^{-3} , and the axial variation was weak, showing less than a factor of two change throughout the brightest region of the plasma. The high mass diffusivity of all of the species present made it unlikely that a large density gradient existed anywhere in the plasma at steady state. This result was also evident by the good fit to a Gaussian profile recorded on the argon-hydrogen plasma rather than a Voigt profile as shown in Figure 10. In addition, the line broadening for Balmer β , γ , and δ was comparable to that of Balmer α ; whereas, an absence of broadening beyond the instrument width was observed for the lines of argon or helium species such as the 667.73 nm and 591.2 nm Ar I lines and 667.816 nm and 587.56 nm He I lines. Thus, the Stark broadening was also insignificant.

A linear Stark effect arises from an applied electric field that splits the energy level with principal quantum number n into $(2n - 1)$ equidistant sublevels. The magnitude of this effect given by Videnovic et al. [8] is about

$2 \times 10^{-2} \text{ nm} / \text{kV} \cdot \text{cm}^{-1}$. No appreciable applied electric field was present in our study; thus, the linear Stark effect should be negligible. The absence of broadening of the noble gas lines and the hydrogen lines of the controls confirmed the absence of a strong electric field. No charged resonator cavity surfaces were present since the plasmas was contained in a quartz tube with the cavity external to the tube. A microwave E-mode field does exist in the Evenson cavity that is a function of the reflected power [37-38], and the catalysis reaction is dependent on this field as discussed previously [39]. However, there is no cathode fall region and the magnitude of the microwave field is comparably much less than that found in the cathode fall region of a glow discharge cell.

To investigate whether the rt-plasmas of this study were optically thin or thick at a given frequency ω , the effective path length $\tau_{\omega}(L)$ was calculated from

$$\tau_{\omega}(L) = \kappa_{\omega} L \quad (5)$$

where L is the path length and κ_{ω} is the absorption coefficient given by

$$\kappa_{\omega} = \sigma_{\omega} N_H \quad (7)$$

where σ_{ω} is the absorption cross section and N_H is the number density of the absorber. For optically thin plasmas $\tau_{\omega}(L) < 1$, and for optically thick plasmas $\tau_{\omega}(L) > 1$. The absorption cross section for Balmer α emission is

$\sigma = 1 \times 10^{-16} \text{ cm}^2$ [40]. By methods discussed previously [41-42], an estimate of the $n=2$ H atom density based on Lyman line intensity is $\sim 1 \times 10^8 \text{ cm}^{-3}$. Thus, for a plasma length of 5 cm , $\tau_{\omega}(5 \text{ cm})$ for Balmer α is

$$\tau_{\omega}(5 \text{ cm}) = \kappa_{\omega} L = (1 \times 10^{-16} \text{ cm}^2)(1 \times 10^8 \text{ cm}^{-3})(5 \text{ cm}) = 5 \times 10^{-8} \quad (8)$$

Since $\tau_{\omega}(5) \ll 1$, the argon-hydrogen plasmas were optically thin; so, the self absorption of 656.3 nm emission by $n=2$ state atomic hydrogen may be neglected as a source of the observed broadening.

As discussed above, an estimate based on emission line profiles places the total H atom density of the argon-hydrogen plasma at $\sim 3.5 \times 10^{14} \text{ cm}^{-3}$. Since this is overwhelmingly dominated by the ground state, $N_H = 3.5 \times 10^{14} \text{ cm}^{-3}$ will be used. Usually, the atomic hydrogen collisional cross section in plasmas is on the order of 10^{-18} cm^2 [43]. Thus, for $N_H = 3.5 \times 10^{14} \text{ cm}^{-3}$, collisional or pressure broadening is negligible.

The broadening reported in the Committee's reference URL:

<http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf> is 0.37 cm^{-1} with no field and 3.7 cm^{-1} with the application of the microwave field. The energies corresponding to these

widths are $4.5 \times 10^{-5} \text{ eV}$ and $4.5 \times 10^{-4} \text{ eV}$, respectively, which is absolutely negligible compared to the $>10 \text{ eV}$ hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The Committee's alternative explanation is off by six orders of magnitude.

The Committee continues its argument regarding Luque et al. on page 17 of the present Office Action, stating:

Luque et al. carried out an analogous microwave discharge plasma experimental setup (see Figure 1 of Luque et al.) involving Ar gas where H was present in a trace amount. Luque et al. explained that under their operating conditions, the whole broadening attained by the profiles of the Balmer H α line is the result of two Lorentzian broadenings, the Stark ($\Delta\lambda_S$) and van der Waals ($\Delta\lambda_W$) ones and two Gaussian broadenings, the Doppler ($\Delta\lambda_D$) and the instrumental ($\Delta\lambda_I$) ones (see p. 1580 of Luque et al.). It appears in the Mills et al. "Comparison of Excessive Balmer α Line Broadening" document, applicant has not taken into account broadening of the line profile by the two Lorentzian broadenings in their microwave discharge plasma experiment involving the Ar/H mixture. Applicant state on pages 7 and 8 of the Mills et al. "Comparison of Excessive Balmer α Line Broadening" document that only a Gaussian profile was used to fit the line profile of the Balmer α line. It appears that applicant ignored significant contributions to the line broadening due to dynamic Stark broadening (one of the components of Lorentzian broadening) in interpreting his data.

As shown above, the electron density that was measured by a Langmuir probe and matched that measured independently on Ar/H₂ plasmas under similar conditions (See references cited in #49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355), was six orders of magnitude too low to account for the observed broadening. Each hydrogen emission peak fit a Gaussian shape, not a Voigt curve. And, only the H lines were broad. Stark broadening would effect all lines, not just the hydrogen lines.

Furthermore, the Stark effect was considered and eliminated. Specifically, from 49. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Comparison of Excessive Balmer α Line Broadening of Inductively and Capacitively Coupled RF, Microwave, and Glow

Discharge Hydrogen Plasmas with Certain Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. (2003), pp. 338-355:

Stark broadening of hydrogen lines in plasmas can not be measured at low electron densities using conventional emission or absorption spectroscopy because it is hidden by Doppler broadening. In the case of the Lyman α line, the Stark width exceeds the Doppler width only at $n_e > 10^{17} \text{ cm}^{-3}$ for temperatures of about 10^4 K [34]. Gigosos and Cardenoso [35] give the observed Balmer α Stark broadening for plasmas of hydrogen with helium or argon as a function of the electron temperature and density. For example, the Stark broadening of the Balmer α line recorded on a $H + He^+$ plasma is only 0.033 nm with $T_e = 20,000 \text{ K}$ and $n_e = 1.4 \times 10^{14} \text{ cm}^{-3}$.

The relationship between the Stark broadening $\Delta\lambda_s$ of the Balmer β line in nm , the electron density n_e in m^{-3} , and the electron temperature T_e in K is

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where $C_0 = 22.578$, $C_1 = 1.478$, $C_2 = -0.144$, and $C_3 = 0.1265$ [36]. From Eq. (5), to get a Stark broadening of only 0.1 nm with $T_e = 9000 \text{ K}$, an electron density of about $n_e \sim 3 \times 10^{15} \text{ cm}^{-3}$ is required, compared to that of the argon-hydrogen plasma of $< 10^9 \text{ cm}^{-3}$ determined using a compensated Langmuir probe, over six orders of magnitude less. Regional maxima in electron densities that could give rise to Stark broadening was eliminated as a possibility. The measured electron densities did not exceed 10^9 cm^{-3} , and the axial variation was weak, showing less than a factor of two change throughout the brightest region of the plasma. The high mass diffusivity of all of the species present made it unlikely that a large density gradient existed anywhere in the plasma at steady state. This result was also evident by the good fit to a Gaussian profile recorded on the argon-hydrogen plasma rather than a Voigt profile as shown in Figure 10. In addition, the line broadening for Balmer β , γ , and δ was comparable to that of Balmer α ; whereas, an absence of broadening beyond the instrument width was observed for the lines of argon or helium species such as the 667.73 nm and 591.2 nm Ar I lines and 667.816 nm and 587.56 nm He I lines. Thus, the Stark broadening was also insignificant.

A linear Stark effect arises from an applied electric field that splits the energy level with principal quantum number n into $(2n - 1)$ equidistant sublevels. The magnitude of this effect given by Videnovic et al. [8] is about $2 \times 10^{-2} \text{ nm} / \text{kV} \cdot \text{cm}^{-1}$. No appreciable applied electric field was present in our

study; thus, the linear Stark effect should be negligible. The absence of broadening of the noble gas lines and the hydrogen lines of the controls confirmed the absence of a strong electric field. No charged resonator cavity surfaces were present since the plasmas was contained in a quartz tube with the cavity external to the tube. A microwave E-mode field does exist in the Evenson cavity that is a function of the reflected power [37-38], and the catalysis reaction is dependent on this field as discussed previously [39]. However, there is no cathode fall region and the magnitude of the microwave field is comparably much less than that found in the cathode fall region of a glow discharge cell.

The broadening is unequivocally Doppler broadening as discussed in References #49 and #37. The microwave-field broadening cited in Committee's Luque et al paper is six orders of magnitude too low to account for the broadening reported by Applicant (e.g., Ref. #49). In fact, the point of the paper by Luque et al. was the very technically difficult Doppler-free two-photon excitation to show the microwave effect, which can not otherwise be observed since it is overwhelmed by the Doppler broadening.

In additional arguments, the Committee once again has difficulty in interpreting basic scientific data, when it states on pages 17-19 of the present Office Action that:

Luque et al. was able to fully account for the line broadening of the Balmer H α line in a gas mixture comprising Ar and H only with two Lorentzian components and two Gaussian components as stated above. These components fully account for the broadening of the Balmer H α line due to proper analysis of the electron density and ion dynamics in the system by Luque et al. There is no need to use a resonant energy transfer mechanism to explain the broadening of the Balmer H α line when an alternative conventional explanation offered by Luque fully accounts for the broadening of the H α line in a mixture of H₂/Ar in a microwave discharge experiment.

Furthermore, another microwave discharge experiment by Luggenhölscher et al. ("Investigations on Electric Field Distributions in a Microwave Discharge in Hydrogen", obtained from <URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf>>) that is similar to that disclosed in the Mills et al. "Comparison of Excessive Balmer α Line Broadening" document involving a hydrogen and an argon mixture shows anomalous line broadening of the Balmer H α line that can be attributed to microwave plasma effects. Applicant's assertion that the extraordinary line broadening is due to a radiative transfer mechanism is not convincing

because the line broadening can be due to conventional effects as explained above.

Applicant has incorrectly assumed that the Doppler effect (the Gaussian component) is the main cause of the line broadening in microwave discharge plasmas as stated in Mills et al. "Comparison of Excessive Balmer α Line Broadening" document. Furthermore, applicant incorrectly states that there was no electric field present in the microwaves plasma and therefore the results of the Balmer α line broadening cannot explained by Stark broadening (see page 12 of Mills et al. "Comparison of Excessive Balmer α Line Broadening" document). The microwave plasma contains an internal electric field due to the ions and electrons present in the plasma and this internal electric field causes dynamic Stark broadening of the Balmer H α line. Applicant's incorrect assertion regarding the mechanism of this line broadening in the Balmer H α line is enough to disqualify all of applicant's arguments based on anomalous or excessive line broadening in microwave plasmas due to a resonance transfer (r-t) mechanism.

In response to these arguments, Applicant submits that the Committee is grossly in error of the relative difference between the results in Applicant's paper #49 and those of the Committee's Luque et al. paper. The broadening reported in the Committee's reference URL: <http://www.phys.tue.nl/FLTPD/Luggenhoelscher.pdf> is 0.37 cm⁻¹ with no field and 3.7 cm⁻¹ with the application of the microwave field. The energies corresponding to these widths are 4.5×10^{-5} eV and 4.5×10^{-4} eV, respectively, which is absolutely negligible compared to the >10 eV hot H found in rt-plasmas. The microwave field can not explain Applicant's results. The microwave field can not explain Applicant's results of extraordinary broadening observed in these cells with catalysts present and not observed under identical conditions with no catalyst present.

The Committee should have taken better care in reading the units of Fig. [1] that are in cm⁻¹, **NOT nm**. The difference is about **SIX ORDERS MAGNITUDE** in H energy.

In addition, the extraordinary selective H broadening is also observed on rt-cells where there is no RF/microwave field, as reported in the following papers:

81. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in

Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts", European Physical Journal-Applied Physics, in press.

55. R. Mills, P. Ray, R. M. Mayo, "Chemically-Generated Stationary Inverted Lyman Population for a CW HI Laser", European J of Phys. D, submitted.
57. R. L. Mills, P. Ray, "Spectroscopic Characterization of Stationary Inverted Lyman Populations and Free-Free and Bound-Free Emission of Lower-Energy State Hydride Ion Formed by a Catalytic Reaction of Atomic Hydrogen and Certain Group I Catalysts", Journal of Quantitative Spectroscopy and Radiative Transfer, No. 39, sciencedirect.com, April 17, (2003).
54. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts", J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1504-1509.
51. R. Mills, P. Ray, R. M. Mayo, "CW HI Laser Based on a Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Group I Catalysts", IEEE Transactions on Plasma Science, Vol. 31, No. 2, (2003), pp. 236-247.
46. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population and a Very Stable Novel Hydride Formed by a Catalytic Reaction of Atomic Hydrogen and Certain Catalysts", Optical Materials, in press.
42. R. L. Mills, P. Ray, "A Comprehensive Study of Spectra of the Bound-Free Hyperfine Levels of Novel Hydride Ion $H^-(1/2)$, Hydrogen, Nitrogen, and Air", Int. J. Hydrogen Energy, Vol. 28, No. 8, (2003), pp. 825-871.

After making these gross errors, the Committee concludes, without basis, on page 19 of the present Office Action:

Thus, in view of the serious mathematical and scientific flaws in applicant's theoretical foundation for his invention that is contrary to known science, the lack of independent, reproducible experiments that verify the existence of the hydrino atom, and the lack of experimental evidence for one electron atoms having an atomic mass of at least four characterized by an increased binding energy greater than the binding energy of the corresponding ordinary atomic ion as presently claimed, applicant has failed to provide preponderance of evidence to support his claims.

As demonstrated by its flawed arguments, it is clear that the Committee, being a defender of a failed quantum theory, does not grasp physical concepts and an understanding of Applicant's solution of the electron. Applicant has used Maxwell's equations and special relativity correctly as shown by the remarkable agreement between calculations and observations for hundreds of observables given in handbooks, as shown in the following papers:

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction", *Physica Scripta*, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium Which Predicts Conjugate Parameters from a Unique Solution for the First Time", *Progress of Physics*, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One-Through Twenty-Electron Atoms", *Physics Essays*, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach", *Physics Essays*, submitted.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics", *Fondation Louis de Broglie*, submitted.
58. R. L. Mills, "Classical Quantum Mechanics", *Physics Essays*, in press.
21. R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", *Int. J. Hydrogen Energy*, Vol. 27, No. 5, (2002), pp. 565-590.
17. R. Mills, "The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory", *Int. J. Hydrogen Energy*, Vol. 26, No. 10, (2001), pp. 1059-1096.
5. R. Mills, "The Hydrogen Atom Revisited", *Int. J. of Hydrogen Energy*, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.
1. R. Mills, *The Grand Unified Theory of Classical Quantum Mechanics*, September 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com; January 2004 Edition posted at www.blacklightpower.com.

The Committee's stubborn refusal to admit that this success can not be emulated by SQM is troubling. So is its refusal to acknowledge that the operability of Applicant's disclosed invention is supported by the 58 peer reviewed publications, the 49 papers

under review, and the 51 independent validation reports summarized in the attached documents, which report the reaction of atomic hydrogen with catalysts to form lower-energy hydrogen and release energy.

But perhaps the most disconcerting of all the Committee's strained arguments are the ones that rely on the opinions of Examiner Bernard Souw, who authored the attached Appendix. See, for example, pages 12-13 of the present Office Action, wherein the Committee argues:

With respect to applicant's theory, sections 4 through 10 of the ATTACHMENT in paper #12 provide substantial evidence that applicant's theory is contradictory, physically unsound, and mathematically incorrect. Complementary scientific arguments demonstrating the incorrectness of applicant's theory can be found in the attached appendix by Dr. Bernard Souw, a patent examiner in art unit 2881, that was cited in copending case 09/513,768 which also claims the hydrino atom as the basis of the invention therein. [Emphasis in original.]

As discussed in detail below, Applicant's response to the arguments presented in the Souw Appendix, as well as the Committee's extreme bias in relying on Examiner Souw's conflicted positions, defeats all of these arguments. In a bit of irony, the Committee further asserts on pages 13-14 that "applicant's theory lacks credibility for reasons given in the ATTACHMENT in paper #12 and in the attached appendix by Dr. Bernard Souw." Applicant has rebutted point by point each and every argument presented in these papers and explained why those arguments lack credibility on the merits. Applicant has further shown lack of credibility with respect to Dr. Souw's arguments due to his bias, as demonstrated by his reliance on his own technical papers to reject Applicant's claims and by a genuine conflict of interest involving Dr. Souw's ownership of, and work as lead scientist for, a company competing with BlackLight at the same time he has been examining BlackLight's cases.

These relevant facts demonstrate a clear case of bias on the part of the Committee that, along with Applicant's overwhelming experimental evidence of lower-energy hydrogen that the Committee has either misconstrued or ignored altogether, demand immediate allowance of all claims in this and Applicant's other pending cases.

**Reliance By Examiner Souw On His Own Published Papers
To Reject Applicant's Claims On Theoretical Grounds Is Blatantly Unfair**

Applicant notes with dismay the citation in the Appendix to Examiner Souw's own technical papers published in the journal *Physica*. The citation of those papers against Applicant's claims on theoretical grounds is inherently unfair for several obvious reasons.

First, the Committee has failed to show that the journals in which those technical papers appear are any more "scientifically qualified" with appropriate review process than the journals that published Applicant's papers. Unless and until the PTO does so, the credibility of Examiner Souw's papers will remain an issue and should not be cited against Applicant. Because, however, the Committee continues to rely on those papers, Applicant's papers must also be considered to be scientifically qualified and to far outweigh the scant scientific evidence provided by Dr. Souw. To argue otherwise, as the Committee has done, is an obvious double standard.

Second, for Examiner Souw to cite his own technical papers against Applicant makes it even more unfair, as it limits the Examiner's ability to remain impartial. How can an Examiner be expected to remain unbiased in the face of Applicant's critical arguments when it is his own technical papers that are the subject of those criticisms? The answer is obvious: he can't.

In any case, now that Examiner Souw has relied upon his own scientific research to support the Committee's rejections in this case, Applicant is entitled to know certain details of his background, including his technical education and past work experience.

The Committee has attempted, but utterly failed, to rationalize why Dr. Souw should be allowed to cite without scrutiny his own technical papers against Applicant:

Applicant note[s] the involvement of Examiner Bernard Souw in the examination of another of his applications, and that Examiner Souw had previously worked for Brookhaven National Labs. Two things are thus pointed out. First, examiners are allowed, and even encouraged, to consult other examiners on matters of science. Dr. Souw is the author of the attached Appendix. While originally written for Serial No. 09/513,768, the Appendix is considered relevant to the present application for reasons stated below. Second, the employment history of examiners, including those acting in a consulting role, is irrelevant to the examination thereof,

except where there is a genuine conflict of interest. [See April 14, 2004 Office Action at p. 4 in U.S. App'n. Ser. No. 09/008,947]

The first point—that the PTO generally encourages consultation with other Examiners—is not even in dispute and, therefore, is irrelevant. The point of Applicant's objections to the consultation of Dr. Souw in this specific case is the obvious conflict created by his citing papers he authored. It cannot be seriously argued that Dr. Souw can be unbiased in critically analyzing his own work.

The PTO's second point—that the employment history of Examiners is only relevant when there is a genuine conflict of interest—merely argues in Applicant's favor. It is precisely because Applicant has demonstrated a genuine conflict of interest with regard to Dr. Souw's citation to his own work, undertaken at a government-funded laboratory involved in competitive research sanctioned by the APS, that makes his employment history relevant to the examination of this application. Thus, Dr. Souw's employment history, including his connection to any APS activities during that employment, is highly relevant.

Furthermore, as explained below, the Committee's refusal to provide this relevant information has led Applicant to conduct his own investigation into this matter. This investigation has uncovered what the Committee refers to as "genuine conflicts of interest" on the part of Examiner Souw, which Applicant feared were being withheld.

Regarding the substance of the arguments presented in the Appendix, it appears that the Committee once again prefers engaging in a theoretical debate to the exclusion of Applicant's experimental evidence, pitting its favored quantum theory, with all of its far-fetched and disproved predictions, against Applicant's theory of classical quantum mechanics that correctly predicts the formation of lower-energy hydrogen. Nevertheless, Applicant provides a complete and detailed response to each theoretical point raised in Examiner Souw's Appendix and requests that the Committee fully consider that response. [See Attachment, "Response to Souw Appendix".] Applicant further requests that the Committee: (1) properly consider all of Applicant's experimental evidence appearing in his peer-reviewed journal articles—much of it generated by independent third parties—rather than just a small, isolated portion of that evidence;

and (2) follow its own admitted standard by giving those articles "the credibility that peer-reviewed articles have."

The Committee's Refusal To Disclose the Details of Examiner Souw's Employment History Raises Additional Serious Questions Of Whether It Is Capable Of Fairly Examining Applicant's Cases

The Committee's appointment of Examiner Souw came at a critical juncture in the examination of Applicant's pending cases. In April 2003, Examiner Langel, one of the two original examiners assigned to these cases, had resigned from his examining duties "for moral and ethical reasons." Examiner Langel's abrupt resignation came after being instructed to misrepresent that he favored denying Applicant his patents when the record showed he wanted to allow those patents to issue, and that he had authority to grant that allowance when, in fact, he was told that "allowance is not an option."

To justify Examiner Langel's resignation after the fact, the PTO informed Applicant that his cases were being transferred and consolidated under the direction of a more experienced Examiner, even though Examiner Langel had over thirty years of PTO examining experience. A few short weeks later, Examiner Souw made his first appearance in one of Applicant's cases, U.S. App'n Ser. No. 09/513,768.¹¹²

Applicant was naturally suspicious of these events given the prior prosecution history of his cases, which, as mentioned above, prompted Applicant to raise what he believed were legitimate issues regarding Examiner Souw's bias in examining these cases. Rather than answer a legitimate inquiry into the Examiner's background after he demonstrated bias by citing his own technical papers against Applicant, the Committee became defensive, arguing that "the employment history of examiners, including those acting in a consulting role, is irrelevant to the examination thereof, except where there is a genuine conflict of interest." [See 4/14/04 Office Action in U.S. App'n Ser. No. 09/008,947 at p. 5.] Dr. Souw, who was identified by the Committee as the author of the Appendix that was originally written for the '768 application, responded to

¹¹² See the Appendix attached to the Committee's May 7, 2003 Office Action issued in the '768 application.

Applicant's criticisms this way:

Since the cited Examiner's papers cannot possibly have been criticized by Applicant, citing his own publication(s) does not make the Examiner's view "biased", as alleged by Applicant. In the contrary, such technical papers provide a solid evidence that the Examiner is in possession of sufficient background for evaluating Applicant's claimed invention. In this regard, the Examiner can add a further evidence of strong background in microwave plasmas generated in a resonance cavity similar to those use by Applicant, not only in theory, but also hands-on in its design, construction and routine operation, as well as in its spectroscopy, both low and high resolutions [1]. [Souw Appendix at p. 4 attached to the March 29, 2004 Office Action filed in U.S. App'n Ser. No. 09/513,768.]

The reference [1] cited by the examiner as evidence of his "strong background in microwave plasmas" was the following article published in March 1987: Souw, Eng-Kie, Plasma density measurement in an imperfect microwave cavity, J. Appl. Phys. 61 (5), 1 March 1987.

The Committee's defensive remarks regarding the irrelevancy of Examiner Souw's employment history when contrasted with Examiner Souw's remarks regarding the relevancy of that history are astounding. But what is even more remarkable is when these remarks are considered in the context of additional information that has come to Applicant's attention concerning Dr. Souw's questionable business activities, not in 1987 when his cited article published, but much more recently, after he was hired by the PTO.

Unable to get straight answers from the Committee, Applicant undertook his own investigation, which uncovered these activities relating to Dr. Souw's employment history that were withheld from Applicant. Applicant has now learned that Dr. Souw, while employed by the PTO to examine BlackLight's applications, also does work as the lead scientist for a consulting company that he co-founded, BMS Enterprise (BMS) in Herndon, Virginia, which competes in technical areas that are in the process of being commercialized by BlackLight. Why the Committee and Dr. Souw did not make this new information readily available seems apparent: if correct—and Applicant has no reason to doubt that it is given that the source is another article written by Dr. Souw himself in 2003—there would appear to be multiple violations of the PTO's ethics rule.

At the very least, the ability of Examiner Souw and the Committee to fairly evaluate the merits of Applicant's invention has once again been called into serious question.

The above-mentioned article was published in *Optical Engineering* on November 2, 2003. [Souw, Bernard Eng-Kie, Coherent telescope array with self-homodyne interferometric detection for optical communications, Opt. Eng. 42(1) 3139-3157 (November 2003) (Tab S).] As the author of that article, Dr. Souw's name prominently appears on first page (p. 3139), identifying his association with BMS as follows:

Bernard Eng-Kie Souw
BMS Enterprise
P.O. Box 5524
Herndon, Virginia 20172-5524
E-mail: souw1@juno.com

Equally enlightening is the last page of the article (p. 3157), which includes a summary of Dr. Souw's technical background and work experience establishing his connection to BMS as its co-founder and lead scientist. Applicant reproduces the following relevant portions of this summary, which notably describes BMS as providing consulting services in two main technical areas, microwave plasma devices and CVD diamond synthesis and applications, which disciplines are competitive with those practiced by BlackLight:

In 1985, [Bernard Eng-Kie Souw] joined Brookhaven National Laboratory (BNL) in Long Island, New York as staff member in a Star Wars project. He was awarded a Department of Energy research grant in 1993 and became Principal Investigator in a research and development project on a novel, solar blind and fieldable alpha-beta-gamma radiation detector in collaboration with Northrop-Grumman and New Jersey Institute of Technology. **About the same time he cofounded BMS Enterprise, a multi-interdisciplinary consulting company providing services mainly in microwave plasma devices and CVD diamond synthesis and applications. He left BNL in 1997 and became a patent examiner with the US Patent and Trademark Office in Arlington, Virginia until 2000, when he joined ITT Industries in Reston, Virginia as a scientist and engineering specialist in optical communications. He left ITT in 2002 to dedicate more time as lead scientist with BMS Enterprise.** [Emphasis added.]

Applicant's novel hydrogen technology has many potential commercial applications, including the aforementioned microwave plasma devices and CVD diamond synthesis technologies. Indeed, Applicant presently has on file two copending applications directed to these specific art areas. [See U.S. App'n Ser. No. 10/469,913, filed March 7, 2002; and PCT/US/13412, filed May 1, 2002.] Applicant has serious concerns that these and other technologies that BMS and BlackLight have in common may have effected, and will continue to effect, the manner in which his applications are being handled by the PTO.

This situation is particularly disturbing in light of the PTO's own ethics rules that prohibit patent examiners from engaging in outside business activities that conflict with their assigned administrative duties. [See *Summary of Ethics Rules* for the U.S. Patent and Trademark Office published by the U.S. Department of Commerce, Office of the General Counsel, Ethics Division (attached as Tab S)] As the introductory paragraph to the PTO's ethical rules makes clear, the issue involved here is one of public trust:

PUBLIC SERVICE IS A PUBLIC TRUST

As an employee of the U.S. Patent and Trademark Office you have been placed in a position of trust and are held to a high standard of ethical conduct. This handout contains a summary of the rules set forth in conflict of interest statutes and the *Standards of Ethical Conduct for Employees of the Executive Branch*. [Ethics Rules at p. 1 (Tab S)]

To hold examiners to this high standard of ethical conduct, the rules prohibit activities that would create a financial conflict of interest:

Financial Conflicts of Interest. You may not, as part of your official Government duties, participate in any matter that will have a direct and predictable effect on your personal financial interest, unless an exemption applies. This rule applies to matters involving specific parties in which you have a financial interest and to broad policy matters that affect many entities, including ones in which you have an interest (such as a policy affecting an entire industry sector if you have stock holdings in one of the companies in the industry sector). [Ethics Rules at p. 2 (Tab S) (emphasis in original).]

Other PTO ethic rules govern outside employment activities:

General Rule on Outside Activities. You may not engage in outside employment or any other personal activity that conflicts with your Department position, including employment that requires disqualification from a significant part of your Government duties or an activity that creates an appearance of using your public office for private gain. You must disqualify yourself from participating in a matter as a Department employee which may affect the financial interests of an outside employer or in which an outside employer, or an organization in which you are an active participant, is a party or is representing a party. . . . [Ethics Rules at p. 5 (Tab S) (emphasis in original).]

These restrictions against financial conflicts of interest and outside employment activities are further amplified with specific reference to patent examiners in the following rules:

Financial conflicts of Interest

Conflicts of Interests regarding Patent Examiners If you are a patent examiner, you may not participate in the review of any patent if you have a financial interest in a company that may be affected by the issuance or denial of the patent (unless your interest is in publicly-traded stock valued at \$5,000 or less in all affected companies). . . . [Ethics Rules at p. 10 (Tab S)]

Outside Employment and Activities

Service with Non-Federal organizations If you serve as an officer or director of an outside organization, such as a professional association, you may not participate as a USPTO employee on any matter that is likely to affect the financial interests of the organization. This may preclude you from serving with organizations that are active in matters before your office. If it would benefit USPTO to have an official relationship with a private organization, you may be assigned as a liaison to the organization, in which case your service with the organization would be in an official capacity, rather than as an outside activity. However, you may not be assigned to service in an official capacity as an officer or director of a non-Federal organization (other than a standards-setting body). [Ethics Rules at p. 11-12 (Tab S) (emphasis in original).]

The applicability of these ethics rules to the present situation cannot be seriously disputed. Examiner Souw was a PTO employee at the same time he admits to being

BMS's lead scientist with an apparent ownership stake in that company, shown to be a competing interest with BlackLight. Indeed, records indicate that Examiner Souw was a PTO employee prior to the date *Optical Engineering* first received his BMS article on February 6, 2003, and throughout the time that paper was being revised and received on May 6, 2003, and ultimately published on November 2, 2003.¹¹³

The May 6, 2003 revision date is particularly significant. It was only one day later, on May 7, 2003, that the Committee first began issuing Appendices authored by Examiner Souw, starting with the '768 application, to reject BlackLight's applications. Dr. Souw's conflict of interest in working for BMS during his employ as a PTO examiner—and while drafting rejections of BlackLight's patent applications no less—should be obvious to anyone and, thus, requires no further discussion.¹¹⁴

All of this is particularly upsetting to Applicant, especially when viewed in the context of other questionable activities documented herein, including:

- (1) the withdrawal from issue of five allowed BlackLight applications under suspicious circumstances;
- (2) the rejection of Applicant's claims based on a non-peer reviewed article posted on an Internet bulletin board authored by Dr. Peter Zimmerman, who has bragged about his activities at the State

¹¹³ See, for example, U.S. Patent No. 6,506,648, issued January 14, 2003, which identifies Bernard Souw as the Assistant Examiner. Based on established PTO procedures, Examiner Souw is believed to be the PTO employee who issued the Notice of Allowance in that case, well before January 2003.

¹¹⁴ Interestingly, Dr. Souw mentions in his article that he co-founded BMS in 1993 while working for BNL and that he left BNL in 1997 to join the PTO, apparently while still operating BMS. According to the article, Dr. Souw then left the PTO in 2000 to join ITT Industries as a scientist/engineer in the optical communications field until 2002, when he left "to dedicate more time as lead scientist with BMS Enterprise." Dr. Souw, however, notably fails to mention in the BMS article his apparent re-employment by the PTO, which failure, incidentally, does comply with at least one PTO ethics rule: "you may not use your Government title in connection with a non-Government activity." [[Ethics Rules at p. 7 (Tab S) (emphasis in original)]]

Also somewhat troubling is that Dr. Souw apparently continues to examine and issue applications in other art areas that overlap with his scientific work for BMS, including optical communications, which is the subject matter of his published article. [See, e.g., U.S. Patent No. 6,801,676, filed June 24, 2003 and issued October 5, 2004, on a "Method and apparatus for phase shifting an optical beam in an optical device with a buffer plug," (recognizing in the "Background of the Invention" section that "the need for fast and efficient optical-based technologies is increasing as Internet data traffic growth rate is overtaking voice traffic pushing the need for optical communications.")]

Department in cooperation with the Patent Office in denying Applicant his patents;

- (3) Dr. Zimmerman's improper contact of scientific journals in an attempt to prevent Applicant from meeting the publication requirement imposed by the Committee before his experimental evidence would even be considered;
- (4) Dr. Zimmerman's admission that his APS colleague, Dr. Robert Park, spokesman for BlackLight's competitor APS, has a "Deep Throat" contact at the Patent Office who has provided him with information concerning BlackLight applications; and
- (5) Examiner Wayne Langel's untimely resignation from the examination of BlackLight's applications for "moral and ethical reasons" after being told to materially misrepresent the record and that "allowance is not an option" in these cases.

In view of this sordid prosecution history, Applicant is understandably outraged by the discovery that following Examiner Langel's unfortunate resignation, the Committee appointed Dr. Souw to carry out its "allowance is not an option" policy while he represented a competing interest. Applicant has demanded several times that the PTO provide a complete accounting of the facts and circumstances surrounding prior questionable activities, such as those summarized above. Applicant now makes a similar demand for information in connection with this latest episode involving Dr. Souw's conflicted association with BMS while assigned to examine BlackLight's pending patent applications, including but not limited to a full disclosure of the facts and circumstances surrounding Examiner Souw's:

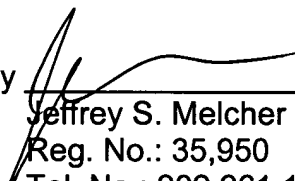
- (1) appointment as an examiner assigned to review BlackLight's pending patent applications;
- (2) outside business activities with BMS Enterprise, and with any other business ventures in which he has a financial interest;

- (3) contact with any sources outside the PTO with regard to the subject matter disclosed in any of BlackLight's applications; and
- (4) membership activities or any other participation in any professional organizations, including the APS.¹¹⁵

Conclusion

For the foregoing reasons, Applicant respectfully submits that the subject application fully satisfies the legal requirements of 35 U.S.C. §§ 101 and 112, first paragraph, and is therefore in condition for allowance. A Notice to that effect is earnestly solicited.

Respectfully submitted,
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¹¹⁵ This information is deemed relevant to the following additional PTO ethics rule:

Appearances of Bias (non-Financial Conflicts of Interest)

Participation in Professional Organizations If you are an active member of a professional organization, such as a member of a[n] association of attorneys or patent professionals, you will be barred from participating in USPTO on matters in which that organization is a party or is representing a party. If this will interfere with your USPTO duties, you should refrain from such activities or should seek advice from the Ethics Division. . . . [PTO Ethics Rules at p. 10 (Tab S)]

As explained in detail above, and in previous Responses, Applicant has good reason to believe that the APS, and perhaps other professional organizations, have become involved as parties in these proceedings.

Journal and Recent Book Publications

107. R. L. Mills, "Maxwell's Equations and QED: Which is Fact and Which is Fiction," *Physica Scripta*, submitted.
106. R. L. Mills, "Exact Classical Quantum Mechanical Solution for Atomic Helium which Predicts Conjugate Parameters from a Unique Solution for the First Time," *Foundations of Science*, submitted.
105. J. Phillips, C. K. Chen, R. L. Mills, "Evidence of Catalytic Production of Hot Hydrogen in RF-Generated Hydrogen/Argon Plasmas," *IEEE Transactions on Plasma Science*, submitted.
104. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, W. Good, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," Division of Fuel Chemistry, Session: Advances in Hydrogen Energy, 228th American Chemical Society National Meeting, August 22–26, 2004, Philadelphia, PA.
103. R. L. Mills, Dhandapani, W. Good, J. He, "New States of Hydrogen Isolated from K_2CO_3 Electrolysis Gases," *Chemical Engineering Science*, submitted.
102. R. L. Mills, "Exact Classical Quantum Mechanical Solutions for One- through Twenty-Electron Atoms," *Phys. Essays*, submitted.
101. R. L. Mills, Y. Lu, M. Nansteel, J. He, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," Division of Fuel Chemistry, Session: Chemistry of Solid, Liquid, and Gaseous Fuels, 227th American Chemical Society National Meeting, March 28-April 1, 2004, Anaheim, CA.
100. R. Mills, B. Dhandapani, J. He, "Highly Stable Amorphous Silicon Hydride from a Helium Plasma Reaction," *Materials Chemistry and Physics*, submitted.
99. R. L. Mills, Y. Lu, B. Dhandapani, "Spectral Identification of $H_2(1/2)$," submitted.
98. R. L. Mills, Y. Lu, J. He, M. Nansteel, P. Ray, X. Chen, A. Voigt, B. Dhandapani, "Spectral Identification of New States of Hydrogen," *New Journal of Chemistry*, submitted.
97. R. Mills, P. Ray, B. Dhandapani, "Evidence of an Energy Transfer Reaction Between Atomic Hydrogen and Argon II or Helium II as the Source of Excessively Hot H Atoms in RF Plasmas," *Contributions to Plasma Physics*, submitted.
96. J. Phillips, C. K. Chen, R. Mills, "Evidence of the Production of Hot Hydrogen Atoms in RF Plasmas by Catalytic Reactions Between Hydrogen and Oxygen Species," *Spectrochimica Acta Part B: Atomic Spectroscopy*, submitted.

95. R. L. Mills, P. Ray, B. Dhandapani, "Excessive Balmer α Line Broadening of Water-Vapor Capacitively-Coupled RF Discharge Plasmas," IEEE Transactions on Plasma Science, submitted.
94. R. L. Mills, "The Nature of the Chemical Bond Revisited and an Alternative Maxwellian Approach," Physics Essays, submitted.
93. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, "Energetic Catalyst-Hydrogen Plasma Reaction Forms a New State of Hydrogen," Doklady Chemistry, submitted.
 92. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, Luca Gamberale, "Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," Central European Journal of Physics, submitted.
91. R. Mills, P. Ray, "New H I Laser Medium Based on Novel Energetic Plasma of Atomic Hydrogen and Certain Group I Catalysts," J. Plasma Physics, submitted.
90. R. L. Mills, P. Ray, M. Nansteel, J. He, X. Chen, A. Voigt, B. Dhandapani, "Characterization of an Energetic Catalyst-Hydrogen Plasma Reaction as a Potential New Energy Source," Am. Chem. Soc. Div. Fuel Chem. Prepr., Vol. 48, No. 2, (2003).
89. R. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, W. Good, P. Jansson, B. Dhandapani, J. He, "Hydrogen Plasmas Generated Using Certain Group I Catalysts Show Stationary Inverted Lyman Populations and Free-Free and Bound-Free Emission of Lower-Energy State Hydride," Fizika A, submitted.
88. R. Mills, J. Sankar, A. Voigt, J. He, P. Ray, B. Dhandapani, "Role of Atomic Hydrogen Density and Energy in Low Power CVD Synthesis of Diamond Films," Thin Solid Films, submitted.
87. R. Mills, B. Dhandapani, M. Nansteel, J. He, P. Ray, "Liquid-Nitrogen-Condensable Molecular Hydrogen Gas Isolated from a Catalytic Plasma Reaction," J. Phys. Chem. B, submitted.
86. R. L. Mills, P. Ray, J. He, B. Dhandapani, M. Nansteel, "Novel Spectral Series from Helium-Hydrogen Evenson Microwave Cavity Plasmas that Matched Fractional-Principal-Quantum-Energy-Level Atomic and Molecular Hydrogen," European Journal of Physics, submitted.
85. R. L. Mills, P. Ray, R. M. Mayo, "Highly Pumped Inverted Balmer and Lyman Populations," New Journal of Physics, submitted.

84. R. L. Mills, P. Ray, J. Dong, M. Nansteel, R. M. Mayo, B. Dhandapani, X. Chen, "Comparison of Balmer α Line Broadening and Power Balances of Helium-Hydrogen Plasma Sources," *Braz. J. Phys.*, submitted.
83. R. Mills, P. Ray, M. Nansteel, R. M. Mayo, "Comparison of Water-Plasma Sources of Stationary Inverted Balmer and Lyman Populations for a CW HI Laser," *J. Appl. Spectroscopy*, in preparation.
82. R. Mills, J. Sankar, A. Voigt, J. He, P. Ray, B. Dhandapani, "Synthesis and Characterization of Diamond Films from MPCVD of an Energetic Argon-Hydrogen Plasma and Methane," *J. of Materials Research*, submitted.
81. R. Mills, P. Ray, B. Dhandapani, W. Good, P. Jansson, M. Nansteel, J. He, A. Voigt, "Spectroscopic and NMR Identification of Novel Hydride Ions in Fractional Quantum Energy States Formed by an Exothermic Reaction of Atomic Hydrogen with Certain Catalysts," *European Physical Journal: Applied Physics*, 28, (2004), 83–104.
80. R. L. Mills, "The Fallacy of Feynman's Argument on the Stability of the Hydrogen Atom According to Quantum Mechanics," *J. Math. Phys.*, submitted.
79. R. Mills, J. He, B. Dhandapani, P. Ray, "Comparison of Catalysts and Microwave Plasma Sources of Vibrational Spectral Emission of Fractional-Rydberg-State Hydrogen Molecular Ion," *Canadian Journal of Physics*, submitted.
78. R. L. Mills, P. Ray, X. Chen, B. Dhandapani, "Vibrational Spectral Emission of Fractional-Principal-Quantum-Energy-Level Molecular Hydrogen," *J. of the Physical Society of Japan*, submitted.
77. J. Phillips, R. L. Mills, X. Chen, "Water Bath Calorimetric Study of Excess Heat in 'Resonance Transfer' Plasmas," *J. Appl. Phys.*, Vol. 96, No. 6, (2004) 3095–3102.
76. R. L. Mills, P. Ray, B. Dhandapani, X. Chen, "Comparison of Catalysts and Microwave Plasma Sources of Spectral Emission of Fractional-Principal-Quantum-Energy-Level Atomic and Molecular Hydrogen," *Journal of Applied Spectroscopy*, submitted.
75. R. L. Mills, B. Dhandapani, M. Nansteel, J. He, P. Ray, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas," *Acta Physica Polonica A*, submitted.
74. R. L. Mills, P. C. Ray, R. M. Mayo, M. Nansteel, B. Dhandapani, J. Phillips, "Spectroscopic Study of Unique Line Broadening and Inversion in Low Pressure Microwave Generated Water Plasmas," *J. Plasma Physics*, submitted.
73. R. L. Mills, P. Ray, B. Dhandapani, J. He, "Energetic Helium-Hydrogen Plasma Reaction," *AIAA Journal*, submitted.

72. R. L. Mills, M. Nansteel, P. C. Ray, "Bright Hydrogen-Light and Power Source due to a Resonant Energy Transfer with Strontium and Argon Ions," Vacuum, submitted.
71. R. L. Mills, P. Ray, B. Dhandapani, J. Dong, X. Chen, "Power Source Based on Helium-Plasma Catalysis of Atomic Hydrogen to Fractional Rydberg States," Contributions to Plasma Physics, submitted.
70. R. Mills, J. He, A. Echezuria, B Dhandapani, P. Ray, "Comparison of Catalysts and Plasma Sources of Vibrational Spectral Emission of Fractional-Rydberg-State Hydrogen Molecular Ion," European Journal of Physics D, submitted.
69. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Spectroscopic Characterization of the Atomic Hydrogen Energies and Densities and Carbon Species During Helium-Hydrogen-Methane Plasma CVD Synthesis of Diamond Films," Chemistry of Materials, Vol. 15, (2003), pp. 1313-1321.
68. R. Mills, P. Ray, R. M. Mayo, "Stationary Inverted Balmer and Lyman Populations for a CW HI Water-Plasma Laser," IEEE Transactions on Plasma Science, submitted.
67. R. L. Mills, P. Ray, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma," J. Phys. D, Applied Physics, Vol. 36, (2003), pp. 1535-1542.
66. R. L. Mills, P. Ray, "Spectroscopic Evidence for a Water-Plasma Laser," Europhysics Letters, submitted.
65. R. Mills, P. Ray, "Spectroscopic Evidence for Highly Pumped Balmer and Lyman Populations in a Water-Plasma," J. of Applied Physics, submitted.
64. R. L. Mills, J. Sankar, A. Voigt, J. He, B. Dhandapani, "Low Power MPCVD of Diamond Films on Silicon Substrates," Journal of Vacuum Science & Technology A, submitted.
63. R. L. Mills, X. Chen, P. Ray, J. He, B. Dhandapani, "Plasma Power Source Based on a Catalytic Reaction of Atomic Hydrogen Measured by Water Bath Calorimetry," Thermochemica Acta, Vol. 406, (2003), pp. 35-53.
62. R. L. Mills, A. Voigt, B. Dhandapani, J. He, "Synthesis and Spectroscopic Identification of Lithium Chloro Hydride," Materials Characterization, submitted.
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60. R. L. Mills, J. Sankar, P. Ray, A. Voigt, J. He, B. Dhandapani, "Synthesis of HDLC Films from Solid Carbon," Journal of Material Science, Vol. 39, (2004), pp. 3309-3318.

59. R. Mills, P. Ray, R. M. Mayo, "The Potential for a Hydrogen Water-Plasma Laser," *Applied Physics Letters*, Vol. 82, No. 11, (2003), pp. 1679-1681.
58. R. L. Mills, "Classical Quantum Mechanics," *Physics Essays*, in press.
57. R. L. Mills, P. Ray, "Spectroscopic Characterization of Stationary Inverted Lyman Populations and Free-Free and Bound-Free Emission of Lower-Energy State Hydride Ion Formed by a Catalytic Reaction of Atomic Hydrogen and Certain Group I Catalysts," *Journal of Quantitative Spectroscopy and Radiative Transfer*, No. 39, sciencedirect.com, April 17, (2003).
56. R. M. Mayo, R. Mills, "Direct Plasmadynamic Conversion of Plasma Thermal Power to Electricity for Microdistributed Power Applications," 40th Annual Power Sources Conference, Cherry Hill, NJ, June 10-13, (2002), pp. 1-4.
55. R. Mills, P. Ray, R. M. Mayo, "Chemically-Generated Stationary Inverted Lyman Population for a CW HI Laser," *European J of Phys. D*, submitted.
54. R. L. Mills, P. Ray, "Stationary Inverted Lyman Population Formed from Incandescently Heated Hydrogen Gas with Certain Catalysts," *J. Phys. D, Applied Physics*, Vol. 36, (2003), pp. 1504-1509.
53. R. Mills, "A Maxwellian Approach to Quantum Mechanics Explains the Nature of Free Electrons in Superfluid Helium," *Low Temp. Phys.*, submitted.
52. R. Mills and M. Nansteel, P. Ray, "Bright Hydrogen-Light Source due to a Resonant Energy Transfer with Strontium and Argon Ions," *New Journal of Physics*, Vol. 4, (2002), pp. 70.1-70.28.
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Prior Conference Presentations

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49. B. Dhandapani, R. Mills, "Novel Liquid-Nitrogen-Condensable Molecular Hydrogen Gas" (Physical Chemistry Session) , Wednesday, June 11, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
48. P. Ray, R. Mills, "Extreme Ultraviolet Spectroscopy of Helium-Hydrogen Plasma" (Physical Chemistry Session) , Wednesday, June 11, 2003, 36th Middle Atlantic Regional Meeting of American Chemical Society, (June 8–11, 2003), Princeton University, Princeton, NJ.
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46. J. He, R. Mills, "TOF-SIMS and XPS Studies of Highly Stable Silicon Hydride Films" (Inorganic/Solid State Session), Monday, June 9, 2003, 36th Middle Atlantic

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